FACTORS INFLUENCING THE GROWTH AND NUTRITIONAL STATUS OF INFANTS AND YOUNG CHILDREN IN RURAL JORDAN

By

SAAD S. HIJAZI, M.D., M.P.H., D.C.H.

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Department of Human Nutrition

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PLAN OF THE THESIS

This study attempts to investigate the different factors influencing the growth pattern and nutrition of children in this community. It covers a wide range of variations. The widely accepted classical approach to such studies (i.e. introduction, samples, methods, results and discussion) cannot be applied due to the wide ranges of variations covered. Instead, we dealt with each chapter separately and each one was followed with its relevant discussion. In some cases the discussion of one or more topics was combined and dealt with separately.

The general discussion, conclusions and recommendations (Chapter IX) covered some important aspects of this study only; more detailed discussion of the same topics as well as many others were also discussed in the respective chapters. Hence, it will be noticed that the discussions are distributed in the different chapters. The contents will indicate their location in the text.

ABSTRACT

This cross-sectional study describes the clinical, anthropometric and haematological findings of 3,734 Jordanian infants and young children in the rural part of Amman. The birth dates were known from the birth registry.

The purpose of the study was to evaluate the growth and nutrition of children ten years after a previous survey, since during the interval there have been dramatic social, economic and political changes in this area.

Detailed tables and graphs for the following anthropometric measurements were constructed for children during the first year of life at one month intervals and for the whole group (0-5 years) at three month intervals: weight, height, weight/height ratio, head circumference, arm circumference and skinfold thickness (triceps, biceps, subscapular and suprailiac).

The mothers' weights were also recorded and showed some significant relation to the childrens' nutritional status.

In addition, weight and height at birth of more than 700 newborns from the lower middle class section of Amman were analysed; they were live born, normal, healthy singletons: they were recorded as a reference.

Using Waterlow's public health classification the children of the main sample were divided into two major groups: the well nourished and the malnourished.

In each group a statistical examination was made of more than 80 variables, which covered a wide range of social, economic and environmental factors believed to contribute to the state of failure to thrive and malnutrition in this community. Many of these factors considered responsible for growth retardation and under-nutrition in other communities in the developing world did not seem responsible in this community; however, there are some other variables which were found to be unique and specific to Jordan. They are described and discussed in some detail.

Infant feeding in this community is also witnessing some important changes; especially in respect to weaning age and the introduction of solids. Milk (other than mothers' milk) because it is prepared in unhygienic and unsanitary ways, is becoming a factor responsible for growth failure and under-nutrition.

The introduction of solid foods together with breast feeding proved to be very efficient in growth promotion.

The disease pattern of these children showed a high prevalence of diarrhoeal and upper respiratory tract diseases. Measles was an important predisposing factor to malnutrition. Measles vaccination proved its efficiency in protecting the children from malnutrition, unlike the other routinely used vaccines.

TO THE MEMORY OF MY FATHER

CONTENTS

CHAPTER I

JORDAN - BACKGROUND OF LAND AND PEOPLE

Jordan is a developing Arab country formed from the East Bank and West Bank of the River Jordan. The East Bank constitutes what was formerly known as the Emirate of Trans-Jordan established as a British Mandate in 1921 by the League of Nations and proclaimed 'The Hashemite Kingdom of Jordan' after achieving independence in 1946, (Toni and Mousa, 1973). The West Bank is that part of Palestine, excluding the Gaza Strip which was annexed to Jordan after the Arab-Israeli War in 1948. Unity between the two banks came into being in 1950. However, the West Bank fell under Israeli occupation in 1967 (Ministry of Culture, Jordan, 1974-a).

Geography: Jordan has a total area of 96,188 Km^2, including the Dead Sea. The total East Bank area is 88,000 Km^2. Eighty per cent of this area is desert or semi-desert. The Dead Sea area is 755 Km^2. The West Bank is an enclave of 6,633 Km^2 amounting to 6.3 per cent of the total land area.

Jordan is situated off the southern shores of the Mediterranean between latitudes 29° and 33° north and longitudes 34° and 39° east and extends eastwards into the Arabian Desert. It is bounded by Syria in the north, Iraq in the east and south and what was left from Palestine in the West (Ministry of Culture and Information, Jordan, 1974-b).

Jordan's only outlet to the sea is a 40 Km stretch of coast on the Read Sea at Aqaba. The Jordan River, which rises in Syria and flows south to the Dead Sea is the chief source of irrigation in the country.

Geology, Climate and Vegetation: The country consists of two main parts; there is a mountainous part composed of two tableland areas with altitudes varying from 600 to 1,000 metres. Between these highlands is a rift valley which drops to an average depth of 300 metres below sea level (Toni and Mousa, 1973).

The prevailing wind is westerly to south westerly, with more humidity in the north than in the south. The occasional easterly winds are cold and dry in winter and hot and dry in summer. The maximum summer temperature in the highlands is 33° C while in winter the temperature rarely falls below 7° C. In the Jordan Valley temperatures reach 40° C in summer and seldom fall below 14° C in winter. The highlands have an average rainfall of 400 mm, the rift valley an average of 200 mm and the desert region less than 50 mm, (Ministry of Culture and Information, Jordan, 1974).

The distribution of vegetation follows the pattern of rainfall: pine and oak forests where rainfall is heaviest, shrub covered steppe where it is less and sparse shrub and thorn where it is least.

Population: The people of Jordan are made up of three distinct groups: town dwellers, peasant farmers or villagers and pastoral nomads (Bedouins). The habits and ways of life of the three groups differ widely. 33% of the population live in rural areas and 66 per cent live in urban areas.

In 1972 Jordan's population was estimated at 2,467,000 (1,270,000 men and 1,197,000 women); 1,747,000 living on the East Bank and 720,000 on the West Bank. The density of population is 25 persons per square kilometer.

The present day distribution of population in Jordan is largely the result of both geography and history. 96.1 per cent of the total population lives in 24.4 per cent of the country's total land area. The volume and direction of internal migration in Jordan have been largely determined by the movements of refugees. It is estimated that at least 35 per cent of the people in Amman were born in Palestine (Department of Statistics, Jordan, 1974, and Ministry of Health Reports, 1974).

The child population (less than 15 years old) was 1,126,000. In 1972 the birth rate was 48 per thousand and the registered mortality rate 13 per thousand.

In 1974, the 0 - 4 years age group was estimated to constitute 20.6 per cent of the population. Thus the percentage of the 0 - 14 year old age group in 1974 was estimated at 49.5 per cent.

In 1972 Amman, the capital, had a population of 550,000 and the other two principal towns, Zerka and Irbid 213,000 and 110,000 respectively. No statistical data is available for the West Bank cities since the occupation in June 1967.

<u>The Impact of the 1967 War</u>: Jordan suffered the most from fighting; the occupation of the West Bank ~~lead~~ led to a heavy blow to its economy and related matters. Not only was its agriculture revenue reduced by half, but Jordan's principal industry, tourism, nearly disappeared with the loss of Jerusalem. To

make things worse about 250,000 newly displaced persons crossed over the bombed Allenby Bridge from the West Bank and the Gaza Strip to the East Bank. This added to an already over-burdened economy.

Education: Jordan has five levels of schooling: kindergarten for the age group 3 - 5 years; elementary for the 6 - 11 year age group; secondary for the 12 ~~16~~ - 17 year age group and the higher education level (University and teaching/technical institutes) for the age group 18 - 23. There are also special schools for the handicapped. A three year course of professional training is given at the Jordan College of Nursing in Amman. The main objectives of the newly established (1972) medical school in Jordan are directed towards community health and community medicine.

The number of students in all the government schools amounts to 26.6 per cent of the population on the East Bank. The percentage of the government's total budget which is spent on education amounts to 6.8 per cent, (Ministry of Culture and Information, Culture and Education, Jordan 1974).

Public Health Services: In Jordan up-to-date information on public health is scarce. The annual statistical book of the Ministry of Health is a written manuscript simply describing the duties and functions of each department. The information presented here is based mainly on some figures and tables included in the latest issues of the annual statistical book and also from the general department of statistics in Jordan, together with some personal experience gained over more than 13 years in the Ministry of Health as a senior Paediatrician-Nutritionist, and also some computations from the raw data presented in these reports (Ministry of Health reports, Jordan 1962-1974).

Population Statistics: Population statistics in Jordan are derived from the current registration of births and deaths which was introduced in 1926, and which, especially since 1950, has been successively improved in the completeness and variety of the investigated facts.

Because of many socio-economic and educational factors, the registration of births in Jordan is known to be accurate and satisfactory, unlike the registration of deaths which was found to be only about 40 per cent complete.

The level of fertility in Jordan is high. The total fertility rate is 6.8 children per woman and the gross reproduction rate is 3.3 girls per women during the child bearing years. The birth rate for the year 1974 was 46.5 per 1,000 population.

According to some studies the crude death rate was estimated to be about 16 per 1,000 rather than 7 per 1,000 as suggested by the returns of registration (Wander, H., 1966).

The WHO year book (1975) estimates infant mortality rate in Jordan as 9 per cent of live births.

The natural growth rate was estimated to be 3.1 per cent per year so that the trend in population growth in Jordan is clearly upward. Mortality will continue to decline for some time to come and accelerate growth, that is as long as fertility keeps its present high level.

Table 1 shows the age structure of the population in Jordan according to the 1961 census figures, calculated for 1974 from estimates of the population's annual growth.

Table 1

Age Group (years)	% of Total Population
0 - 4	334,530 (17.7%)
5 - 9	266,490 (14.1%)
10 - 14	241,920 (12.8%)
Total < 15 years	842,940 (49.9%)

Provisions of Health Care in Jordan: This is mainly maintained through the following three agencies: a) the Ministry of Health which covers 50 per cent of the country's needs (civilians), b) the Royal Medical Service which covers 25 per cent of the country's needs (military and civilians), and c) the private and semi-private agencies which cover 25 per cent (private, welfare, refugees and displaced persons, etc.).

All these agencies were able to provide 7.2 ~~per cent of~~ hospital beds per 10,000 people (1974).

Estimates for the year 1975 show that there is one doctor for every 2,000 people; one dentist for every 12,000; one pharmacist for every 7,000; one staff nurse for every 10 hospital beds and one practical nurse for every 4 hospital beds.

At present there is one main governmental paediatric hospital, one military paediatric section, a recently established paediatric ward within the University Hospital, paediatric wards in the general hospitals in the country and also a few paediatric beds in the private hospitals.

There are 36 MCH centres in Jordan at the present time, 20 in towns and 16 in villages, in addition to 10 UNRWA MCH centres mainly serving the refugee population. If the ratio of these centres is to reach one centre for every 10,000 people then the country needs another 19.

Calculations of the number of vaccinations registered by the Ministry of Health records for 1974 showed that only 4.1 per cent of the total number of 0 - 4 year old children were given the first dose of poliomyelitis and triple vaccine and smallpox vaccination. The number of children receiving BCG vaccinations was only 6.7 per cent.

A simple direct analysis of the Ministry of Health budget shows that 9.98 per cent of the total budget is spent on a preventative medicine programme; 55.11 per cent on curative medicine; 2.41 per cent for teaching and training purposes; 1.62 per cent for dental health and 0.7 per cent for the Vaccine Institute of Jordan and none for the vaccination programme (Ministry of Health report, 1974).

Nutrition in Jordan: In 1962 a nutrition survey was designed by ICNND to assess the nutritional situation in Jordan, to identify major needs and to provide information which would aid in the solutions of the problems and needs so identified.

The plan for this survey was essentially that followed in other ICNND nutrition surveys and the methods were those detailed in the Manual for Nutrition Surveys (1963), prepared by the ICNND, as revised in keeping with experience in other countries and adapted to the special needs and conditions in Jordan.

This survey showed that there were low levels of intake of vitamin A and riboflavin among all sections of the population with confirmatory biochemical evidence and clinically manifest deficiences of these nutrients in certain groups. It also revealed the presence of severe forms of malnutrition among infants and young children, and also growth retardation in children.

In order to meet the needs resulting from this survey the following recommendation was made: "In view of the grave significance of the problem of infant malnutrition it is recommended that the findings of a continuing study of infant malnutrition be used to supplement the information contained in the present report for purposes of planning improved educational programmes on infant feeding in maternal and child health centres and also for training medical and para-medical personnel in Jordan".

So, in 1962 and in keeping with this recommendation another nutrition survey was carried out on 2,843 children from 0 - 5 years of age from the various regions of Jordan and their nutritional condition was presented.

This survey again provided definite evidence of malnutrition in children, particularly in weight and height patterns, the dietary pattern, low vitamin A and carotene levels, low riboflavin excretion, anaemia and the presence of clinical cases of marasmus, pre-kwashiorkor and kwashiorkor.

Few recommendations for specific measures were presented; they mainly dealt with vitamin A supplementation, improvements of MCH services, availability of educational materials and also the need to produce baby foods from locallygrown cereals and grains. However, the last recommendation stated: "Further standards of growth for children in Jordan should be developed by careful observation on infants in homes and selected well baby clinics. These should include carefully made and documented records of height, weight, age and pertinent clinical and dietary information and records of illness".

So far, this recommendation has not been implemented irrespective of its need and importance.

The nutritional situation of the refugees and displaced persons after the June 1967 Middle East War was studied and an assessment was made of the nutritional state of the people who suffered as a result of that War.

The findings of this survey revealed the presence of mild to moderate degrees of malnutrition together with deficiencies of vitamin A and riboflavin, and iron deficiency anaemia. The hygienic environment of these people was poor, as exemplified by a high prevalence of acute conjunctivitis, scabies, pediculosis and flea bites (Pharaon and Hijazi, 1969).

Different sporadic reports from hospitals in Jordan indicated that 25 - 30 per cent of total hospital admissions were of children suffering from different forms of malnutrition. The mortality rate among these hospitalized children was reported to be high, 25 - 35 per cent (Pharaon 1962; Pharaon and Hijazi, 1967; Hijazi 1974).

<u>Project Objectives and Importance:</u> The reasons for undertaking this study were:

1. It would be the first of its kind to put forward a realistic picture of the growth pattern of the pre-school child in Jordan. The plan was to classify children according to Waterlow's public health classification system. This would help in putting forward a programme for action for the different nutritional groups specified in the classification. It would also help in comparing our results with accepted Western standards and other similar studies.

2. This study is expected to generate a series of national growth studies which would be of great value in the assessment of growth of individual children in the community and would also provide a basic sample population from which sub-samples could be drawn for scientific specialised studies of various aspects of health, such as physical and mental development in relation to nutritional and social factors. The area under study could be a convenient place for the suggested community and social paediatric programmes of Jordan's new medical school.

3. The 1964 Nutrition Survey showed a specific trend in the growth pattern of the Jordanian children. The present study, should detect any changes which have occurred since then. Changes are to be expected because of the dramatic social and economic events which have taken place during the last decade, including internal troubles and external wars.

4. The study will make it possible to assess the relationship between the following factors and the pattern of growth of the Jordanian child:

a) family, social and economic conditions

b) environmental factors

c) access to health services and health education

d) feeding and weaning patterns

e) mortality and morbidity patterns in this community.

Knowledge of the variables serves a number of administrative and scientific purposes. It is essential for proper evaluation of the existing curative and preventative services in the country.

5. The socio-cultural aspects of infant feeding in Jordan will be studied. This will help more efficient planning of health education programmes.

6. The study of infant feeding, weaning practices and weaning foods will help to assess the need for manufacturing a new weaning food in Jordan and the chances of its acceptance.

The Present Study: From the beginning it was quite apparent that the best way to achieve the objectives set out above would be by a survey of the whole country, but this was beyond the ability of one main investigator. Therefore, the survey was limited to the rural area round Amman because of the following factors:

a) the sampling procedure is simple, the community is stable, and almost every child in this community is within the reach of the investigator

b) easy access to transportation (range of distance from Amman is 5 to 25 Km)

c) the people of the rural areas in Jordan are more cooperative and friendly

d) the chosen community is representative of the rural areas of Jordan; this fact was approved of and supported by Jordan's Department of Statistics

The Villages of Amman's Rural Area: Table 2 shows the names of these villages and the number of males and females examined in each village.

These villages vary in size from tiny settlements of 100 inhabitants to ones of 5,000 people. The larger villages usually occupy flattish land near the top of the scarp. The smaller villages, with a population of between 100 and 500 inhabitants, lie in fairly close proximity to the larger settlements. These are often overflow settlements from the main community which has expanded beyond the limit of cultivated land. Other small villages, however, stand isolated on a scarp or a main road. Some of these settlements have attained considerable size with the inflow of 1948 Palestinian refugees. One of these villages (El Taibeh) was established recently, after the 1967 War.

These villages are an example of the average Jordanian village which is a fairly compact settlement with houses huddled close together. The average house is built of dressed or undressed stone, each with a little courtyard surrounded by a wall. In the smaller villages mud brick houses are fairly common. The village house is one storey high, rarely two, and in its simplest form consists of one or two rooms with an adjoining courtyard for the animals.

Kinship forms the basis of social organization in the village and many of the smaller villages are inhabited by joint families or descendants of one common ancestor. In the larger villages definite quarters of the settlement are inhabited by separate lineages which may or may not be related. Villages situated near urban settlements, however, show quite a few characteristics of town life. Here the houses come closed to urban architectural styles; electricity and running water have been introduced; family ties become less strict and a variety of occupations besides agriculture may be found.

Some of the families studied lived in tents, but not all the tented population are necessarily nomadic. Some of these are cultivators with fairly restricted mobility. The tent does not necessarily signify nomadism proper, for it is sometimes suited to other modes of life. 1971 estimates show that 3 per cent of the total population live in tents.

CHAPTER II

SAMPLING AND METHODOLOGY

Sampling Procedure: The frame of the sample included all the children from 0 - 5 years of age who were born before or during the time of the study in Amman District rural area. For this purpose we used the birth registers. It is estimated that 98 per cent of newborn babies are registered with the Department of Health. Those who were not registered in this area were asked to bring their birth certificates with them. The sample was recorded on records especially designed by the general birth registry of this area. For this purpose four full time clerks made three copies of the information needed for this study. This included the names, addresses, name of the person who reported the birth (i.e. village headman, midwife or a doctor), name of the village and the birth date of the child. The names were recorded in serial order and special codes for every village were given in advance. This was done in order to avoid any confusion or duplication of lists.

In this way we established three comprehensive lists of the population of all the children who were born in this area since 1st September 1969 (i.e. children who were 0 - 5 years old by the time we started the fieldwork. One copy was given to the village headman, a second was given to the nurse at the local clinic or to the midwife, or school teacher or postoffice man or to the secretary of the municipal council of the village, whoever was available. The third copy was retained.

Every chief of a family or a group of people was assigned a number of names. He was responsible for bringing these people on the scheduled day and hour if possible. Every child was given a small green card on which his name and his birth date were recorded. After the completion of the examination the name on the original copy was marked in red ink.

Sample Size: The following factors were responsible for determination of the sample size in this study:

1. The proposed one year interval to survey this area with a team consisting, as originally planned, of one main fieldworker and one assitant. The preliminary proposal was that such a team could examine 3,000 children in the following manner: 15 children/day x 20 days/monthly = 3,000 children.

2. Anthropometry formed an important part of this study and it was proposed to achieve a known degree of statistical confidence in these measurements. We followed the method of Cochrane and Cox (1957) who suggested that by detecting a height difference of 2 cm a sample size of 30 is necessary to give 5 per cent significance level in 50 per cent of trials, and a sample size of 60 to give 5 per cent significance level in 80 per cent of trials.

3. The standard deviation of the measurement which we expected to be greater than that reported by Tanner (1952). A standard deviation of 5 cm was, therefore, considered to be a safe basis upon which to estimate the sample size.

Taking all these points into consideration we thought that a sample size of 2,500 - 3,000 children from the age group 0 - 5 years would then fit these requirements.

However, when we finished the comprehensive listing of all the children from 0 - 5 years old who were born in this area since 1st September 1969 and until the time of the actual fieldwork, we found that the total number was 4,200 children.

It was clear from this point that an unknown number of these children had died, and another small part of the sample had by the time of the study moved away or left the area and it was expected that a third group might not cooperate for many reasons in this study. Bearing all these facts in mind and assuming a response rate of 70 - 75 per cent, then the actual sample size would be around 3,000 children, and therefore we decided to examine every child included in our lists and any other child who moved into this area from the same age group, provided he had a birth certificate.

Response Rate and Exclusions: Every effort possible was made to ensure proper and complete coverage of the children listed in the original list of names.

The distribution* of free milk and biscuits to the children who attended was a successful incentive for better participation by the villagers. A carton of biscuits and two cans of powdered milk were given to each child; some medicines

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*The milk, biscuits, baby foods and other pharmaceutical products were kindly donated by the main companies. See Acknowledgements for their list of names and addresses.

or vitamins and iron were given if needed. Milk and biscuits were also distributed to the following: the local nurse and maid, the headman of the village, the school Principal and maid and some other influential people in the community.

The actual number of children who were examined was 3,881. However, we have excluded 147 children from this study for the following reasons:

1. Children who were mentally retarded, regardless of etiology (19 children)
2. Children with apparent congenital malformation such as clubfoot, congenital dislocation of the hip joint and other deformities which affected the physical fitness of the child (19 children)
3. Children with poliomyelitis or any paralytic condition (7 children)
4. Children with congenital heart disease, judged mainly by the presence of a murmur only of grade II and more (13 children)
5. Children of multiple births (89 children)

This procedure resulted in the exclusion of 147 children from all the age groups.

The net response rate was therefore 85 per cent from the group of children registered on our lists* in addition to 90 children who had moved into the area and those who had their birth certificates with them.

Choice of the 0 - 5 Age Group: In Jordan the child of pre-school age has certain biological and cultural characteristics that make him particularly precariously poised as regards health and nutrition. It is in this age group that the

*The total number registered on our lists was 4,460 children.

highest growth velocity occurs especially in the first two years (Tanner et al, 1966). As a result the nutrient requirements are also highest in this age period, so it is to be expected that more serious effects will be apparent as a result of nutritional deficiencies.

It is also in this age group that we have most of the feeding and weaning problems (WHO Seminar 1969) and the problems of diarrhoea, dehydration and its resulting high morbidity and mortality levels.

Physically, the pre-school child is at risk because of differences in fluid metabolism, in particular a much higher daily need for water than adults; a more rapid turnover of extracellular fluid, and a less efficient urinary concentration process (Jelliffe, 1968).

Also it is in this age that the child is at an interim period immunologically. He has lost maternal antibodies and he is in the process of building his own active immunity (Jelliffe, 1968).

Until recently the magnitude of this problem in Jordan was expressed on the basis of assumption and experience. A proper recognition of the gravity of this problem demands collection of data from representative areas and age groups and proper analysis and interpretation.

Preparatory Visits and Other Activities: A circular was sent out by the Ministry of Health to all the people concerned, offices, clinics, MCH centres and transport division explaining the purposes of this study and its objectives, asking them to cooperate and to let us use the available facilities for the success of the study.

A similar circular was also sent to and telephone contact was made between the Director of Education in Amman District and all the schools in the villages under study. They also agreed to let us use some of the classes as examination rooms.

A month before the actual start of the survey 52 visits were paid to the responsible people in these villages, mainly the headmen, school teachers, local clinic nurses and to the municipal councils of some villages if available: the main purpose of these visits was to make the team and the people familiar with each other, and to explain properly the purpose and importance of the study to the local people in simple straightforward language. Another motivation to guarantee proper participation was to tell the headman of one village that we wanted to know whether this village was healthier than the neighbouring village with whom there was a historical competition for getting the clinic or the post office or the school first. We felt that this was a good incentive for better participation.

The Questionnaire: A special booklet of 16 pages was printed in both Arabic, for the general questionnaire section, and in English for the section on clinical and anthropometric measurements. The questionnaire was made up of the following sections:

1. General information related to different social, economic, cultural and health conditions of the family
2. Morbidity pattern
3. Child feeding and weaning practices
4. Anthropometric measurements
5. Clinical examinations
6. Haemoglobin and haemocrit values.

Specially designed spaces for computer use were already printed on these forms.

Provisions were made for the information to be transferred directly from the questionnaire onto punch cards. The answers to most questions were precoded and space was provided on the left hand side for the answers to be coded directly by the field workers themselves. This is a time-saving procedure and might reduce coding errors. Special codes for some questions were provided, these were filled in according to a special coding system at a later stage.

The questionnaire was designed one year before the actual start of the field work. Advice was sought from many people who had had similar and different experiences to our own in similar surveys in Jordan and in different aspects of hospital clinical work for more than ten years in Jordan and abroad. (See the questionnaire in Appendix I).

Anthropometric Measurements: Although there is still disagreement on the proper choice of anthropometric measurements, it is generally agreed that the measurements should be easy to obtain with cheap unelaborate apparatus, that the indices obtained should be reasonably simple to interpret and to calculate, and that they should provide a guide to action.

Growth can be assessed by several different parameters, some of which are very sophisticated; however, for the sake of our proposed study in a rural part of Jordan where there is a big need for getting a clear picture of the pattern of our pre-school children, a balance had to be made between the choice of having many suggested measurements, or just taking weight and height measurements. It was then decided to use the measurements recommended by Jelliffe, (1966). These are weight, height and or length, skinfold thickness, arm and head circumferences.

Because it was felt necessary to measure the distribution of fat in our children it was decided to measure the skinfold thickness in four locations: biceps, triceps, subscapular and suprailiac. Arm circumference was included as a measure of muscle mass and head circumference was included first for its academic value, and later for other practical purposes.

Equipment: The following instruments were used:

1. Lightweight baby scales, manufactured by Herbert & Sons Limited and modified to measure infants. These scales weigh accurately to 10 gms. but readings were taken only to the nearest 50 gms. below.

2. Lightweight personal scales, manufactured by Herbert & Sons Limited and weighing accurately to 50 gm; readings were taken only to the nearest 50 gm. below.

3. The Harpenden Infant Measuring Table in its modified form (Infastad) to measure infants and children up to five years. This instrument was manufactured by Holtain Limited; it is not too big to carry for field work purposes. It has the added advantage of being suitable for use in two positions, vertically to measure height and horizontally to measure length; however, it was used mainly throughout the study for length measurements only. This instrument gives an accurate and direct reading to the nearest millimeter over a range of 230 mm to 1,200 mm.

4. The Harpenden Portable Studiometer, manufactured by Holtain Limited; this instrument gives accurate and direct readings to the nearest millimeter over a range of 850 mm to 2,060 mm.

5. The Holtain/Tanner - Whitehouse Skinfold Caliper for the measurement of subcutaneous tissue, manufactured by Holtain and developed in close collaboration with the London University, Institute of Child Health. Its measuring range is from 0 mm to 480 mm with constant pressure of 10 gms/sq mm.

6. Tape measures: Micromatic tapes manufactured by Stanley Mabo (France) were used for the measurement of head and arm circumference.

<u>Measurement Technique</u>: In order to make the results comparable with those of other workers, the techniques laid down by the International Biological Programme

(1969) were used. For skinfold thickness however, the techniques described by Durnin and Rahaman (1967) were employed.

Arm circumference and skinfold thickness were always measured on the left side. A detailed account of the technique is given in Appendix II.

Survey Routine: The routine of the survey consisted of the following steps:
1. A preparatory period in the village through the use of the available mass media and through continuous contact with the local nurse, midwife, etc. The loudspeakers of the mosques of the village were used to call the people to attend on the day of the actual start of the examination (more details are given in the paragraph on preparatory visits).

As a result of these activities we got the best response in attendance during the first day or two when we had 60 - 70 per cent of all those who were registered crowded in front of the clinic. We assembled the people into small groups to attend the clinic on special days and hours if possible. The high attendance on the first few days of the survey was followed by a sharp decline and poor attendance on the following days, and it was at this stage that we made every effort possible to ensure that people came to be examined. On numerous occasions we went with the local nurse or headman of the village to collect the children who had not attended the clinic. Sometimes, we converted a room in a house into a clinic in a residential area where people were unable to come to the original clinic which was situated on the next hill or at the other end of the street. Under such conditions we examined only two or three children.

2. Interviewing the person in charge of the child who was usually the mother for filling in the questionnaire. This procedure was a time consuming step in the beginning but when the interviewers were accustomed to it, the time required was cut by 70 – 80 per cent.

3. The anthropometric measurements were made in the following order: weight, height, head circumference, arm circumference and finally, skinfold thickness.

4. The clinical examination was mainly aimed at detecting signs and symptoms of malnutrition and auscultation for detecting heart murmurs.

5. The child was then referred to the laboratory technician for obtaining a blood sample by a finger or heel prick, and haematocrit determination. (See Appendix III for methods used for haemoglobin and haematocrit determination).

6. Mothers were then weighed and measured.

7. The child was finally given his milk and biscuit, his certificate and his green card marked with red ink and sent home.

Data Editing, Storage and Analysis: The completed questionnaires were returned to the hospital on the same evening. Each questionnaire was checked for gross discrepancies and corrections were made if necessary. Special codes related to the profession of the father and mother, previous and present diseases of the child, disabilities, trade names of milk used, the name of the first solid foods given to the child and the name of the weaning device used by the mother. All these codes were recorded in the appropriate places. It is worth mentioning that these codings were done according to a special agreement with the Department of Statistics and according to a previous personal experience and knowledge of the relevant points or questions.

The computer part of this work was done by the Computer Department, Royal Jordan Scientific Society. The IBM 1130 was used, four cards for each child were made. The checking programme and the analysis of the data were done by a team of one Systems Analyst and four programmers who worked on a full time basis for this project for a period of three and a half months. This team has also prepared a special programme for the testing of different socio-economic and cultural variables against the nutritional status, for this purpose Chi^2 testing was used.

It was through their continuous efforts, conscientiousness and spending many nights until the early hours of the morning to compensate for some hours lost during the daytime as a result of extra work, technical reasons or other administrative difficulties that it was possible to draw conclusions from the data obtained.

For this team of young graduates, as it was for myself, this was the first serious challenge and experience in carrying out a full study such as this with all that it entailed in organisation, checking the accuracy and testing the statistical relations.

Methods Used to Minimise Errors: It is well known that in spite of all the efforts to design and execute an investigation of this kind, errors or variations are still bound to occur, (Walter and Elwood, 1970).

In the context of the present study the possible errors can be divided into three major groups:

1. Errors in completing the questionnaire: we tried to minimise errors during and after the completion of the survey by continuous supervision, advice and repeated training and proper explanation to the group of field workers. Proper attention and care were paid to the known sources of errors involved in completing the questionnaire according to our personal experience with surveys of growth in pre-school children in London and according to many other references.

However, the team members were given a ten day training course which was held at the children's hospital where we used the mothers and children attending the out patient department of the hospital as subjects for this purpose. Every member of the team was provided with a special instruction book written in Arabic for filling in the questionnaire form and for the proper preparation of the child for the measurement procedure.

In order to prevent the duplication of examining the same child twice we used to mark their green cards or their birth certificatates so that they would not be admitted again to the same study; this also helped to prevent some mothers who were living near the clinic or the examination area, from bringing their children again in the hope that they would get more milk or biscuits. This was a not uncommon observation.

please turn to page 37

The physical examination was directed primarily to the detection of signs of nutritional deficiency as recommended by Jelliffe and U.S. ICNND Manual for Nutritional Surveys, (1966 and 1963).

3. Other errors: of other errors the main source was due to mothers bringing a younger or older child to the examination in place of the correct child, who could not come for some reason or other. In some cases this substitution was discovered in the appropriate time during the interview, but some of them escaped notice and gave rise to unusually high or low measurements, as can be seen by studying the data.

The Team: This consisted of the following:

1. The main investigator, paediatrician-nutritionist (full time)
2. Physician-nutritionist (joined the team in the second phase of the field work)
3. Three senior students from the Jordan College of Nursing (three days per week)
4. Two senior students from the Jordan Institute of Social Work (three days per week)
5. A secretary (full time)
6. A male attendant (full time)
7. A laboratory technician (part time)

In some villages, the help of local nurses and midwives was solicited for certain administrative or menial tasks such as free distribution of milk cans to the examinees. In certain instances young educated girls from some villages who showed an interest in the study joined the team and helped to dress and undress babies.

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For minimising errors in coding we used the scheme of checking shown diagramatically in Fig. 1. The reason for this laborious checking was the fact that we had the personnel available for such a job.

It is quite well known that even with these checks and rechecks it is inevitable that some mistakes would have escaped detection. It was hoped that the magnitude of such errors would not be large enough to invalidate the results.

2. Errors in Measurement: special precautions were incorporated to ensure that the instruments were reading correctly. Each morning before starting measurements a special routine check was made by one of the field workers. The weight measuring instruments were checked against a standard weight, also the height measuring machines were checked to read the minimum and maximum counter reading as specified by the manufacturer.

The skinfold calipers were checked against a standard 10 mm disc.

However, it is worth mentioning that all measurements were done by me and 10 per cent of the measurements were checked at random by another single physician-nutritionist throughout the second part of the study. By following this procedure we were able to minimise between observer variation, which is an important part of such studies, (Edwards, Hammond, Healy, Tanner and Whitehouse, 1955).

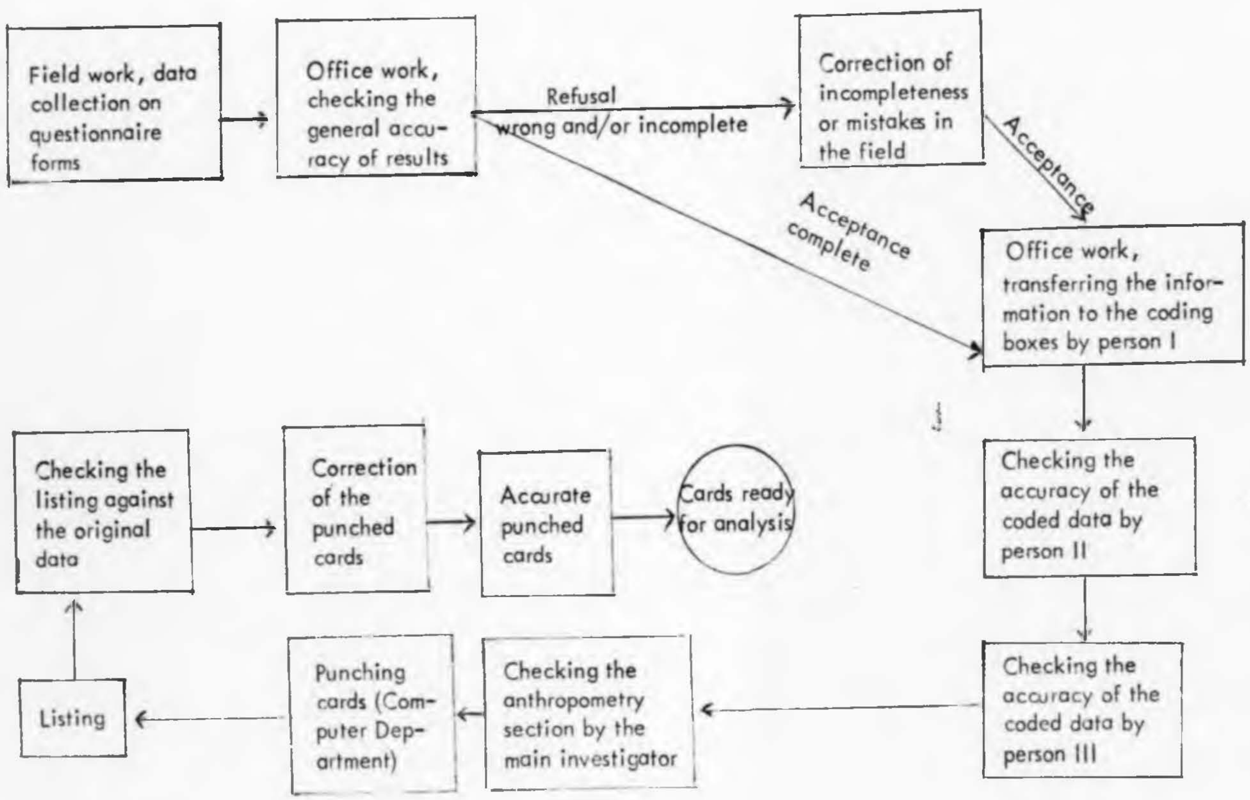


Figure 1 : Flow Chart of Data Checking and Recording

Limitations of the Results: The following points may be considered as limitations of the results and may be worthmore elaboration in further studies.

1. The children were weighed in their underpants and proper corrections were made for this; however, mothers were measured with the lightest clothing possible and corrections were made for this. The estimation was not exact and some minor variations are expected to occur. It was impossible to weigh such clothes as underpants of women in a country like Jordan.

2. The following limitations were commonly encountered in getting answers to the following questions:

a) age of mother and father: it was felt that there was an over estimation of the father's age and underestimation of the mother's age, and because the mother's age is the more important for the sake of this study, a special approach was made to get an accurate assumption of the mother's age within five years. Mothers who did not know their age could often recall the year of their first menstruation and thus the time elapsing after this, before the birth of their first child. If the child's birth was not recorded or known, the school grade gave some indication of their age.

b) Monthly income of the mother and father: this was felt to be often underestimated.

c) The actual area of the land owned may not have been accurately known to the mothers.

d) Social classification system is not available in Jordan, so we used the Professional Classification System (1973) which was not satisfactory for a rural community like the one under study.

CHAPTER III

GENERAL RESULTS

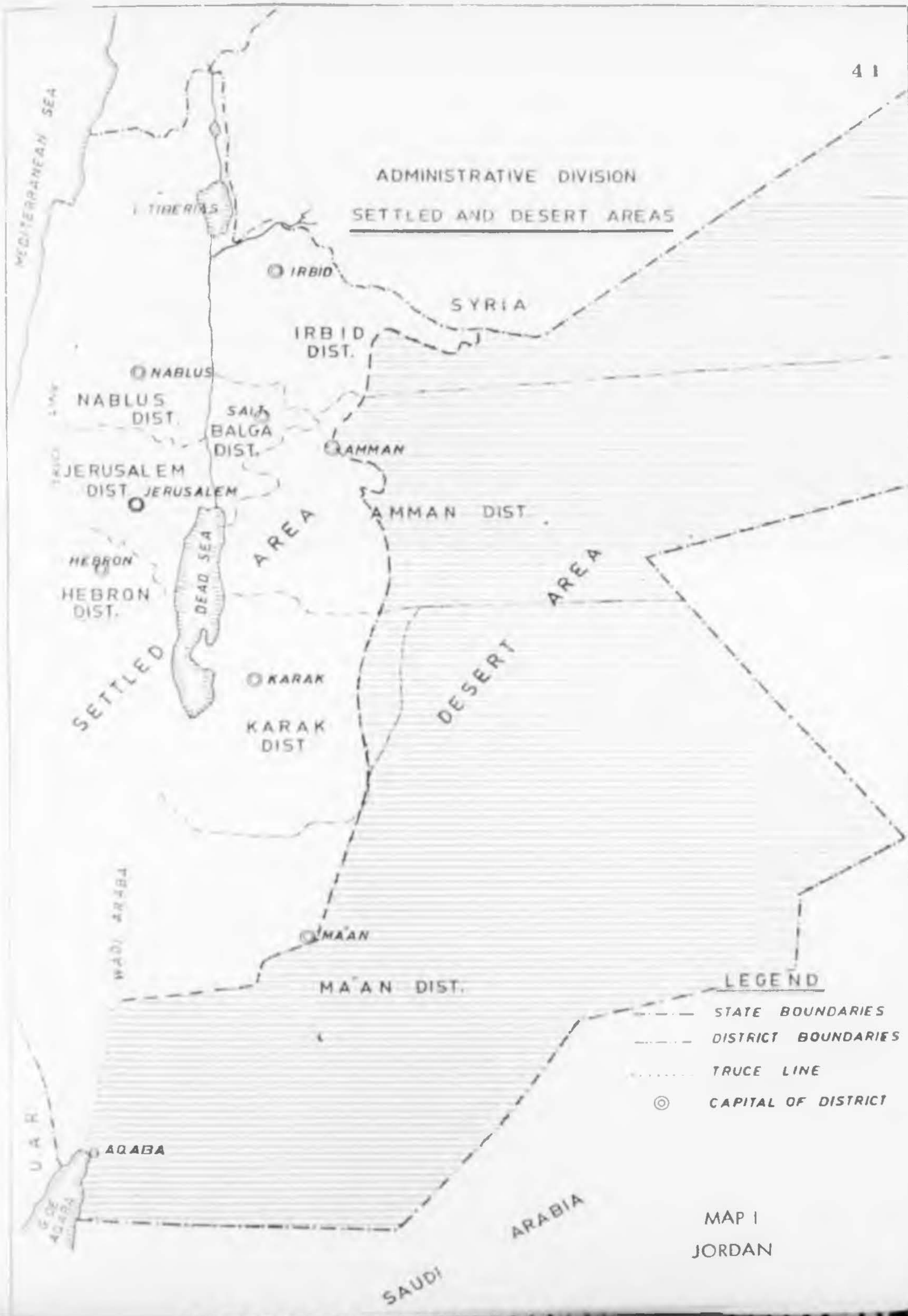
General Description of the Sample: The children, their families and their environment: A total of 1,922 male (51.4 per cent) and 1,812 female children (48.5 per cent) were examined in 15 different villages and locations. The number of children examined in each village varied between 24 and 898 children with a mean of about 250.

Table 2 shows a list of these villages and the number of male and female children examined in each village. Map 1 shows Jordan and map 2 illustrates the location of the villages in the study area. The male-female ratio (1:06) fits in with the sex ratio of the whole country (Jordan's General Census, 1961).

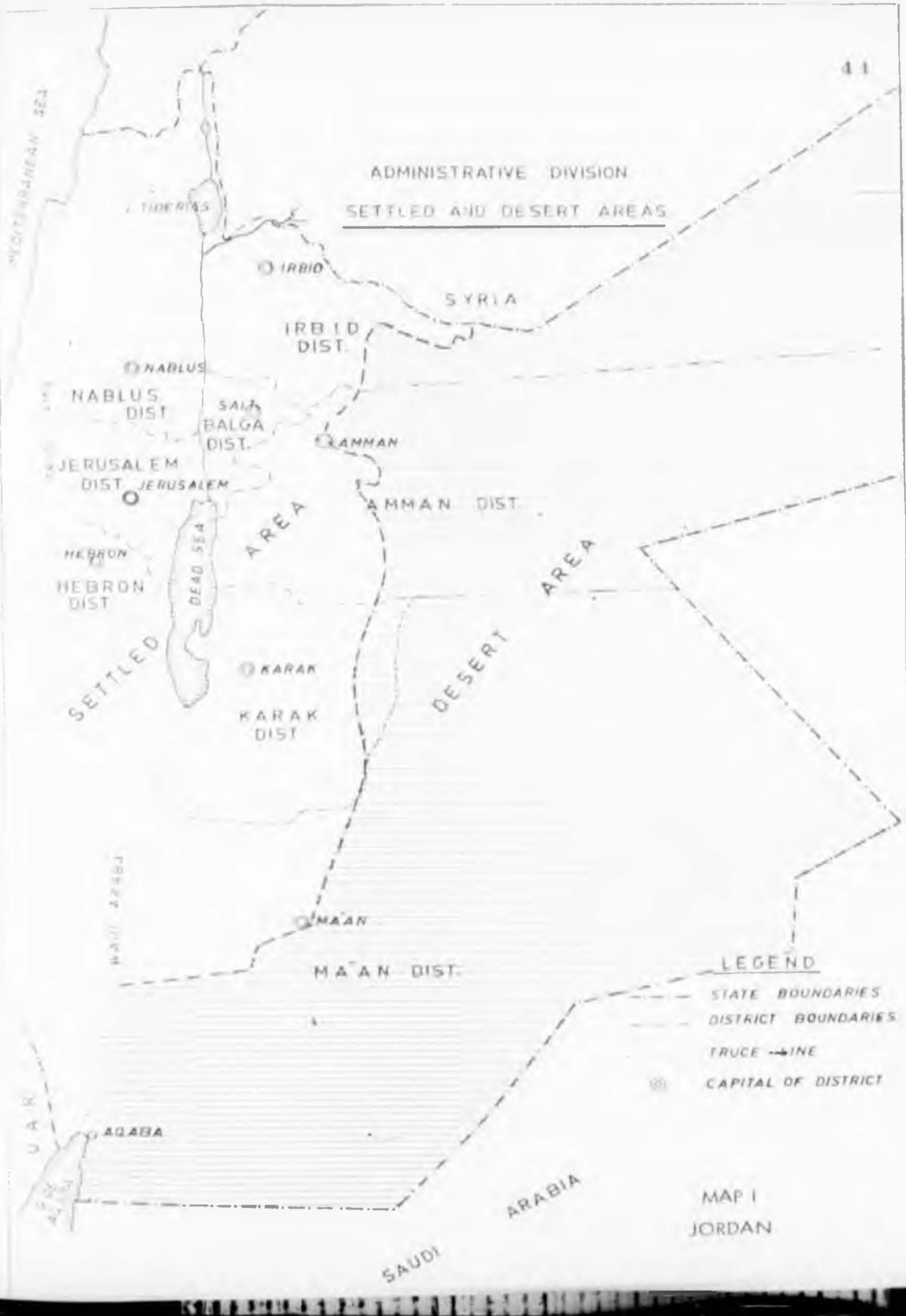
Table 3 shows a breakdown of the age groups and the number of children in each age group. The age intervals during the first year of life were monthly and in the following years, six monthly.

Table 4 shows the number of children who were examined during the different months of the study period (January 1975 to July 1975). More children were examined during the months of the summer and spring because of the weather and the ease of transportation.

Mothers were the main respondents to the questionnaire (95 per cent), however, in a few cases other members of the family, for example, the grandmother, elder sister or father answered the questionnaire.


ADMINISTRATIVE DIVISION
SETTLED AND DESERT AREAS
MEDITERRANEAN SEA
TIBERIAS
IRBID
SYRIA
IRBID DIST.
NABLUS
NABLUS DIST.
SALT
BALGA DIST.
AMMAN
JERUSALEM DIST.
JERUSALEM
AMMAN DIST.
DEAD SEA
HEBRON
HEBRON DIST.
SETTLED AREA
DESERT AREA
KARAK
KARAK DIST
WADI ARABA
MA'AN
MA'AN DIST.
LEGEND
STATE BOUNDARIES
DISTRICT BOUNDARIES
TRUCE LINE
CAPITAL OF DISTRICT
U.A.R.
AQABA
SAUDI ARABIA

MAP I
JORDAN


ADMINISTRATIVE DIVISION
SETTLED AND DESERT AREAS
SYRIA
IRBID
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NABLUS
NABLUS DIST.
SALT
BALGA DIST.
AMMAN
AMMAN DIST.
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JERUSALEM
DEAD SEA
HEBRON
HEBRON DIST.
SETTLED AREA
DESERT AREA
KARAK
KARAK DIST.
MA'AN
MA'AN DIST.
AQABA
U.A.R.
SAUDI ARABIA
LEGEND
STATE BOUNDARIES
DISTRICT BOUNDARIES
TRUCE LINE
CAPITAL OF DISTRICT

MAP I
JORDAN

MAP 2
RURAL AMMAN

MAP 2
RURAL AMMAN

Table 2

Number of Male and Female Children Examined in Each Village, Child Growth Survey, Amman

Village	Male	Female	Total No.	Total Percent
Sweileh	444	454	898	24.05
Al-Jbeiha	61	45	106	2.83
Shafa Badran	98	92	190	5.08
Tlal Al-Ali	47	45	92	2.46
Khalda	58	53	111	2.97
Al-Taybeh	163	153	316	8.46
Khirbet Al-Souk	125	133	258	6.90
Al-Quweismeh	189	199	388	10.39
Al-Gweideh	88	70	158	4.23
Abu-Alanda	211	212	423	11.32
Al-Muqableen	260	193	453	12.13
Al-Husseinieh	40	45	85	2.27
Um-Zweitneh	41	36	77	2.06
Um-Qusair	9	15	24	0.64
Khirbet P. Hassan	88	67	155	4.15
Total	1922	1812	3734	100.00

Table 3

Distribution of Sample by Age and Sex

Child Growth Survey - Amman

Age Group In Months	Male	Female	Total No.	Total Percent
Less than 1 month	16	17	33	0.88
1 - 2	26	34	60	1.60
2 - 3	37	35	72	1.92
3 - 4	26	35	61	1.63
4 - 5	30	32	62	1.66
5 - 6	30	27	57	1.52
6 - 7	39	27	66	1.76
7 - 8	48	35	83	2.22
8 - 9	34	26	60	1.60
9 - 10	33	38	71	1.90
10 - 11	41	26	67	1.79
11 - 12	31	29	60	1.60
12 - 18	203	196	399	10.68
18 - 24	193	155	348	9.31
24 - 30	170	184	354	9.48
30 - 36	176	172	348	9.31
36 - 42	186	169	355	9.50
42 - 48	168	165	333	8.91
48 - 54	170	144	314	8.40
54 - 60	127	107	234	6.26
60+	138	159	297	7.95
Total	1922	1812	3734	100.00

Table 4

Distribution of Children by Sex and Questionnaire Date

Child Growth Survey - Amman

Month	Males	Females	Total	
			No.	Percent
Jan. 75	104	104	208	5.5
Feb. 75	333	329	662	17.7
Mar. 75	160	129	289	7.7
Apr. 75	224	221	445	11.9
May 75	368	377	745	20.0
Jun. 75	551	486	1037	27.8
Jul. 75	182	164	346	9.3
Aug. 75	0	2	2	0.1
Sep. 75	0	0	0	0.0
Total	1922	1812	3734	100.0

Table 5 shows the pattern of distribution by sex and birth date; there is no particular trend in birth date distribution.

Table 6 shows that the great majority of the families in this study had between 4 and 11 persons per household, Histogram 1.

In 99 per cent of cases, the real mothers played the mother's role; in a few cases the grandmother, stepmother or the adoptive mother were the acting mothers. Also, the real father was the main figure acting the role of the father in the house (99 per cent).

The distribution of the partents' ages are shown in Table 7 ; when compared with the fathers' age, mothers were younger; 70 per cent of the mothers were in the age group 20–35 years, while 74 per cent of the fathers were aged 25–45 years.

However, this community exists mainly of two groups of people; the original Jordanians (55 per cent) and the Palestinian refugees and displaced persons (45 per cent); 99 per cent of the whole group are Mulsims and 1 per cent are Christians.

Table 8 shows that 97 per cent of the mothers of children in this study are married, with few widowed or divorced mothers; which indicates the stability and strong marital relations in this community. This subject will be discussed later.

Table 9 shows that nearly 60 per cent of the total marriages in this community are between parents who are first or second degree cousins; 39 per cent of the marriages are between parents who are not related, Histogram 2.

Table 5

Distribution of Children by Sex and Birth Date

Child Growth Survey - Amman

Month of Birth	Males	Females	Total	
			No.	Percent
May	176	217	393	10.5
June	180	172	352	9.4
July	151	162	313	8.4
August	176	154	330	8.8
September	176	139	315	8.4
October	161	137	298	8.0
November	147	122	269	7.2
December	167	136	303	8.1
January	142	134	276	7.4
February	130	140	270	7.2
March	153	139	292	7.8
April	163	160	323	8.7
Total	1922	1812	3734	100.0

Table 6

Distribution of Families According to Number and Percent of Households

Child Growth Survey - Amman

Household Size	3 and Less	4 - 7	8 - 11	12 and More	Unknown	Total
Number	148	1835	1498	228	25	3734
Percentage	4.0	49.1	40.1	6.1	0.7	100.0

Table 7

Distribution of Parent's Age

Child Growth Survey - Amman

Age (Year)	Less 15	15-20	20-25	25-30	30-35	35-40	40-45	45-+	Unknown	Total
					Mother					
Number	2	194	699	1097	791	571	286	63	31	3734
Percentage	0.1	5.2	18.7	29.4	21.2	15.3	7.7	1.7	0.8	100.0
					Father					
Number	0	13	220	574	800	725	661	258	483	3734
Percentage	0.0	0.3	5.9	15.4	21.4	19.4	17.7	6.9	12.9	100.0

Table 8

Distribution by Marital Status of Mother

Child Growth Survey - Amman

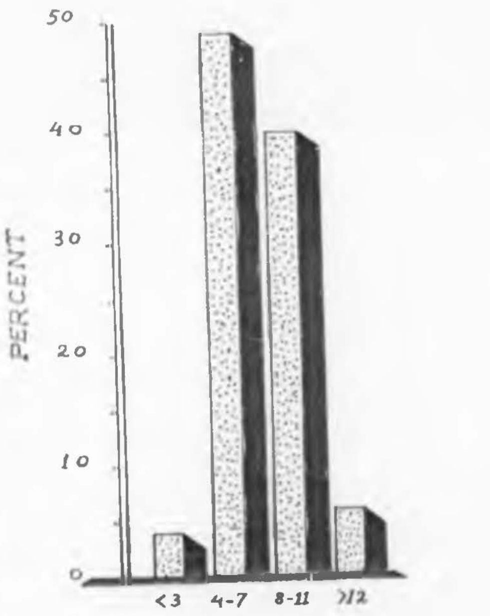
Marital Status	Married	Widowed	Separated/Divorced	Unknown	Total
Number	3628	63	32	11	3734
Percentage	97.2	1.7	0.9	0.3	100.0

Table 9

Distribution by Relation of Father and Mother

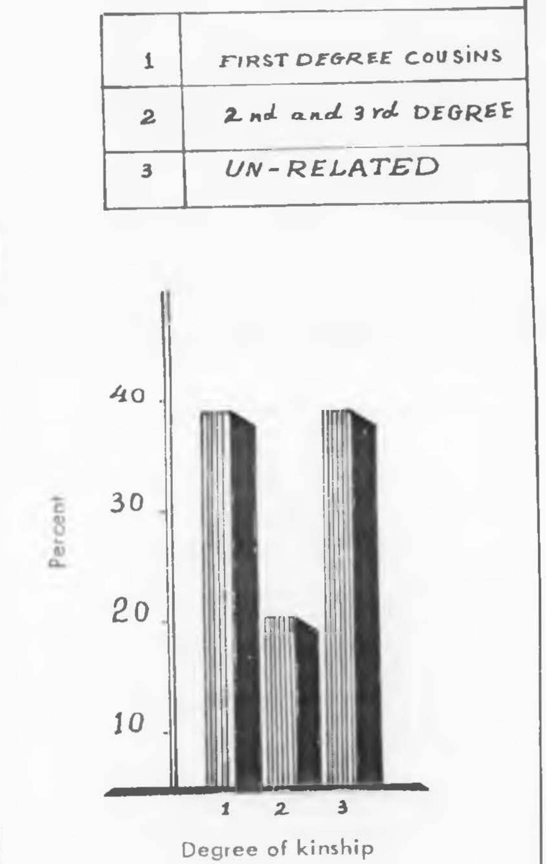
Child Growth Survey - Amman

Relation	First Cousins	Second Cousins	Distantly or not related	Unknown	Total
Number	1448	760	1452	74	3734
Percentage	38.8	20.4	38.9	2.0	100.0

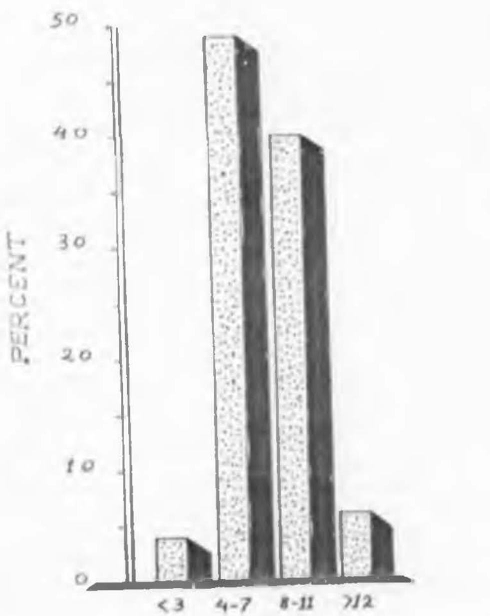


DISTRIBUTION BY FAMILY SIZE

Histogram: 1 percent distribution of the children according to the size of the household



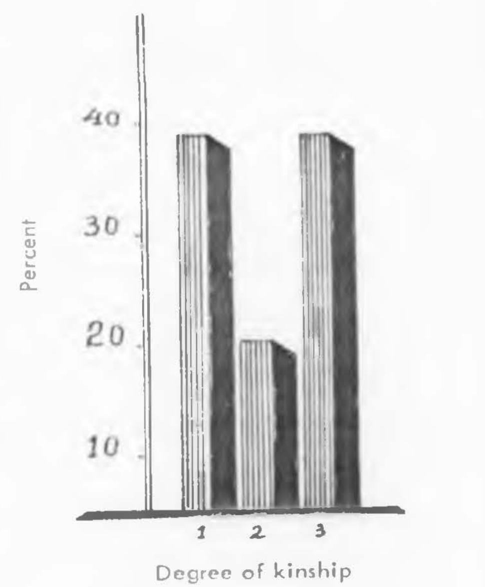
Histogram 2 : percent distribution of children according to the degree of kinship of parents



DISTRIBUTION BY FAMILY SIZE

Histogram: 1 percent distribution of the children according to the size of the household

1	FIRST DEGREE COUSINS
2	2nd and 3rd DEGREE
3	UN-RELATED



Histogram 2 : percent distribution of children according to the degree of kinship of parents

Table 10 shows that nearly 84 per cent of the men were married to one wife; 14 per cent had two wives and 2 per cent had three wives or more.

Economic: Table 11 shows the classification of occupation of the father based on the classification suggested by the Department of Statistics (1973). Of the total group 40 per cent are either agricultural or non-agricultural labourers.

Table 12 shows the monthly cash income of the parents; 12 per cent of fathers and 96 per cent of mothers have no cash income, 61 per cent of the fathers are paid 20-40 J.D. per month.

Table 13 shows land ownership; 80 per cent do not own land, nearly 10 per cent own less than 5 dunums of land.

Table 14 shows that only 13.6 per cent of the families of the children are receiving financial support or aid from their relatives who are working outside Jordan. This was much less than had been expected, especially in view of the huge number of teachers, labourers and other employees from Jordan who work in the oil producing countries.

Education: Table 15 shows that 32 per cent of the fathers and 68 per cent of the mothers of the children in the study were illiterate. Among the literates 33 per cent of the fathers and 21 per cent of the mothers were elementary school graduates (6th grade); and 2 per cent of the fathers were university graduates.

Table 10

Distribution by Number of Wives

Child Growth Survey - Amman

No. of Wives	One Wife	Two Wives	Three Wives	Four Wives	Unknown	Total
Number	3146	515	41	10	22	3734
Percentage	84.3	13.8	1.1	0.3	0.6	100.0

Table 11

Distribution of Children Examined According to Father's Profession

Child Growth Survey - Amman

Father's Profession	Number	Percent
Employee (Government or private)	479	12.8
Military, Police	744	19.9
Labourer (agricultural, non-agricultural)	1528	40.9
Driver (taxi, bus, etc.)	362	9.6
Self-employed (grocer, carpenter, etc.)	237	6.3
Teacher (Government or private school)	97	2.5
Retired (civil, military)	44	1.1
Unemployed	179	4.7
Deceased	63	1.6

Table 12

Distribution by Monthly Income of Parents

Child Growth Survey - Amman

Monthly Income (J.D.)	Less than 10	10-20	20-30	30-40	40-50	50-+	Unpaid	Total
				Father				
Number	75	307	1147	1142	334	280	449	3734
Percentage	2.0	8.2	30.7	30.5	8.9	7.4	12.0	100.0
				Mother				
Number	3	13	55	36	21	17	3589	3734
Percentage	0.0	0.3	1.4	0.9	0.5	0.4	96.1	100.0

Table 13

Distribution by Area of Land Possessed

Child Growth Survey - Amman

Area (1,000 sq. meter)	No land owned	Less than 5	5-10	10-15	15-20	20-25	25-30	30+	Total
Number	3004	358	40	51	34	49	29	169	3734
Percentage	80.4	9.6	1.1	1.4	0.9	1.3	0.8	4.5	100.0

Table 14

Distribution by Those who are Receiving Aid

Child Growth Survey - Amman

Receiving	Yes	No	Unknown	Total
Number	508	3214	12	3734
Percentage	13.6	86.1	0.3	100.0

Table 15

Distribution by Parents' Education

Child Growth Survey - Amman

Level	Illiterate	Read and Write	Elementary School	Preparatory School	Secondary School	Professional/ Technical	University	Unknown	Total
				Father					
Number	1188	359	1233	504	289	50	84	27	3734
Percentage	31.8	9.6	33.0	13.4	7.7	1.3	2.2	0.7	100.0
				Mother					
Number	2547	46	782	224	98	4	10	23	3734
Percentage	68.2	1.2	20.9	5.9	2.6	0.1	0.2	0.6	100.0

Housing Conditions: 69 per cent of the villagers in this community possessed their own homes, while 32 per cent rented the houses they live in, but the rents were low and some of them lived in their parents' houses or on the farm where they worked.

Table 16 shows that most of these families lived in houses with one to three rooms, which indicates that they are living in overcrowded conditions.

Table 17 is a summary of the children whose families had amenities; 22 per cent of the children's homes had baths and 90 per cent had toilets. Nearly half the homes had electricity. Of those who had toilets, 74.5 per cent were made of cement and 20 per cent were soil ditch latrines.

However, of all the families, 69 per cent used kerosene for cooking purposes, 31 per cent used butane gas and 1.2 per cent still used a wood fire for their cooking.

Table 18 shows the source of water in the houses of the children under study. 74 per cent of the houses were supplied with municipal tap water; however, there were 6.8 per cent of homes which had no facilities and to which water was mainly brought by tanks and distributed in the villages.

Access to Health Services: Table 19 shows that 82 per cent of the total deliveries took place at home: the remainder were performed in hospital.

Table 16

Distribution by Number of Rooms in the House

Child Growth Survey - Amman

Number of Rooms	1	2	3	4	5	6+	Unknown	Total
Number	1116	1626	669	183	72	68	0	3734
Percentage	29.8	43.5	17.9	4.9	1.9	1.8	0.0	100.0

Table 17

Percentage of Children Whose Families have Amenities

Child Growth Survey - Amman

Facility	Bath		Toilet		Refrigerator		Butane Gas		Electricity	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Yes	822	22.0	3369	90.2	342	9.1	1188	31.8	1656	44.3
No	2912	77.9	364	9.7	3392	90.8	2546	68.1	2072	55.5
Unknown	0	0.0	1	0.0	0	0.0	0	0.0	6	0.2
Total	3734	100.0	3734	100.0	3734	100.0	3734	100.0	3734	100.0

Table 18

Distribution by Source of Water in the House

Child Growth Survey - Amman

Source (Water)	Municipal Tap Water	Public Tap in Village	Public Spring in Village	Well (Collection)	Others	Total
Number	2765	34	106	572	257	3734
Percentage	74.0	0.9	2.8	15.3	6.8	100.0

Table 19

Distribution by Place of Birth

Child Growth Survey - Amman

Place of Birth	Home	Hospital	Others	Unknown	Total
Number	3056	661	10	7	3734
Percentage	81.8	17.7	0.2	0.1	100.0

Table 20 shows that only 15 per cent of the mothers when they were pregnant, visited the MCH centres; 59 per cent of these visits were in the second trimester (Table 20).

Table 21 also shows that only 9 per cent of the women in this study were visited by a home visiting nurse or midwife during their pregnancy.

Of all the children in this study, only 514 (13.7 per cent) were sent to MCH centres. Most of these visits (71 per cent) were made when the child was 1-6 months old.

Obstetrical Data: By the time this study was undertakne 21.5 per cent of all the mothers questioned were pregnant, 68 per cent were not and 10.5 per cent were not sure.

Table 22 shows that nearly 18 per cent of all the mothers in this study married when they were less than 15 years old; 8 per cent married at an age less than 20 years and 96 per cent were married by 25 years.

Table 23 shows that nearly 62 per cent of all the deliveries were done by either the mother alone or by a trained non-qualified woman in the village. However, 26 per cent were done by a registered midwife and 6.5 per cent by a doctor in hospital. The cases delivered by the doctor were usually the complicated ones which required the intervention of a specialist.

Table 20

Distribution by Visits Paid to Maternity and Child Health Centres
and Visits Paid by the Nurse or Midwife to Pregnant Mothers
Child Growth Survey - Amman

Type of Visit	Yes		No		Unknown		Total
	No.	Percent	No.	Percent	No.	Percent	
Pregnants who Visited MCH	555	14.8	3148	84.3	31	0.8	3734
Pregnants Visited by a Midwife	329	8.8	3386	90.6	19	0.5	3734

Table 21

Trimester of Pregnant Women when Visited MCH Centres

Child Growth Survey - Amman

Trimester (Month)	Less than 3	3 - 6	6 - 9	Unknown	Total
Number	117	327	49	62	555
Percentage	21.0	58.9	8.8	11.1	100.0

Table 22

Distribution by Age of Mothers When Married

Child Growth Survey - Amman

Age (Years)	Less than 15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50+	Unknown	Total
Number	661	2383	551	89	19	6	2	0	0	23	3734
Percentage	17.7	63.8	14.7	2.3	0.5	0.1	0.0	0.0	0.0	0.6	100.0

When mothers were asked about the outcome of their last pregnancy, it was found that 3,694 children were single births, 76 (2 per cent) were twin births.

When mothers were asked about their attitude towards having more children (in addition to those they had already by the time of the study), 54 per cent were willing and 40.5 per cent were not. Of the latter group only one-third were using different types of contraceptive means. In other words, two-thirds of the women who were not willing to have more children were nevertheless not using any contraceptive means for this purpose; However, about 90 per cent of those who did not want more children were in the age group 25-35 years, and were mainly those who already had more than 3-4 children.

Table 24 shows that among those who were using contraceptives, 68 per cent were using the pill, 4 per cent were using the intra-uterine device (IUD) and 28 per cent were using other means, mainly locally used procedures such as the introduction of a piece of cotton soaked in olive oil into the vagina before intercourse or the use of a vaginal vinegar wash before intercourse, or some other procedure like the prolongation of breast feeding.

Table 23

Distribution by Person Who Did the Delivery

Child Growth Survey - Amman

Person	Mother	Trained Woman	Midwife	Doctor	Others	Unknown	Total
Number	556	1748	984	244	171	31	3734
Percentage	14.9	46.8	26.4	6.5	4.6	0.8	100.0

Table 24

Distribution by Type of Contraceptive Used

Child Growth Survey - Amman

Contraceptive	Pills	I.U.D.	Others	Total
Number	371	21	151	543
Percentage	68.3	3.8	27.8	100.0

CHAPTER IV

CLINICAL AND HAEMATOLOGICAL FINDINGS

1. Haematological Patterns: The laboratory indices considered in this chapter consist of haemoglobin and haematocrit. In considering the haemoglobin concentration in the observed group of children, the grading system suggested by the ICNND Manual (1963) was followed; accordingly a mean haemoglobin value less than 8 gm/100 ml is to be considered 'deficient'; levels between 8 - 9.9 gm/100 ml were 'low'; levels between 10.0 - 11.9 gm/100 ml were 'acceptable' and levels between 12 - 15.9 were 'high'.

For haematocrit, levels less than 30 per cent were 'deficient'; levels between 30 - 32 per cent were 'low', levels between 33 - 35 were 'acceptable' and levels between 36 - 46 per cent were 'high'.

Tables 25and 26 and figure 3: show the haemoglobin and haematocrit values in both sexes according to different age groups, in the years 1964 and 1974.

There seems to be no specific trend in the values of haemoglobin and haemotocrit in the two sexes and in the different age groups. However, the values of haemoglobin and haematocrit were relatively lower in the age period from about 6 to 24 months when compared with other age groups.

Pallor, which was more common in face (see the clinical signs) than in mucosa, had the highest peak prevalence in the age period from 9 - 18 months: a finding which also agreed with the low values of haemoglobin and haematocrit in this age period.

Table 25

Haemoglobin Values (gm/100 ml) by Age and Sex

	Males			Females		
Age (months)	No.	Mean	S.D.	No.	Mean	S.D.
0 - 3	39	12.8	2.00	41	12.6	2.20
3 - 6	41	11.9	1.79	53	12.1	1.87
6 - 9	71	10.7	1.37	44	11.1	1.86
9 - 12	59	10.1	1.40	46	10.4	1.48
12 - 15	55	9.9	1.81	52	9.8	1.58
15 - 18	54	9.9	1.82	53	10.1	1.57
18 - 21	45	9.6	1.62	38	9.9	1.53
21-24	60	10.1	1.62	44	10.4	1.65
24 - 27	42	11.6	1.32	57	12.1	1.53
27 - 30	44	12.4	1.63	31	12.6	1.57
30 - 33	49	12.7	1.44	44	12.8	1.69
33 - 36	48	12.4	1.65	55	12.4	1.39
36 - 39	56	12.9	2.05	60	12.8	1.64
39 - 42	39	11.9	1.63	42	12.1	1.56
42 - 45	41	11.8	1.85	35	11.5	1.74
45 - 48	55	12.2	1.76	54	12.0	1.63
48 - 51	42	12.4	1.48	44	12.1	1.47
51 - 54	48	12.2	1.40	33	12.3	1.68
54 - 57	35	12.4	1.74	18	12.2	1.87
57 - 60	37	12.6	1.79	35	12.8	1.77
60 - 63	72	11.9	1.75	94	12.4	1.59

Table 26

Haematocrit Values (Percent) by Age and Sex

Age (months)	Males No.	Males Mean	Males S.D.	Females No.	Females Mean	Females S.D.
0 - 3	34	38.5	4.69	39	38.6	3.35
3 - 6	37	37.9	3.07	46	38.1	2.45
6 - 9	60	36.1	3.35	36	36.7	3.38
9 - 12	62	35.6	3.34	37	35.6	4.44
12 - 15	52	35.8	3.07	54	35.7	2.82
15 - 18	46	35.4	3.39	47	35.9	3.04
18 - 21	46	35.9	2.45	35	35.8	2.91
21 - 24	50	35.9	3.28	42	35.7	2.84
24 - 27	43	37.1	2.97	62	37.3	2.59
27 - 30	42	37.1	2.50	29	37.1	2.46
30 - 33	47	37.3	2.51	39	37.5	3.30
33 - 36	48	37.7	3.49	44	37.9	2.84
36 - 39	49	38.0	3.50	53	38.9	2.52
39 - 42	28	38.3	2.62	40	38.1	2.68
42 - 45	32	38.0	3.73	30	38.3	2.45
45 - 48	54	38.5	2.73	51	38.4	2.28
48 - 51	38	38.1	2.41	40	38.1	3.01
51 - 54	39	37.9	2.06	35	38.4	2.61
54 - 57	39	37.9	2.83	15	37.9	3.28
57 - 60	32	38.1	2.74	30	38.6	2.75
60 - 63	58	38.4	2.80	80	35.5	2.19

Figure 3

HAEMATOLOGIC FINDINGS BY AGE (Years)

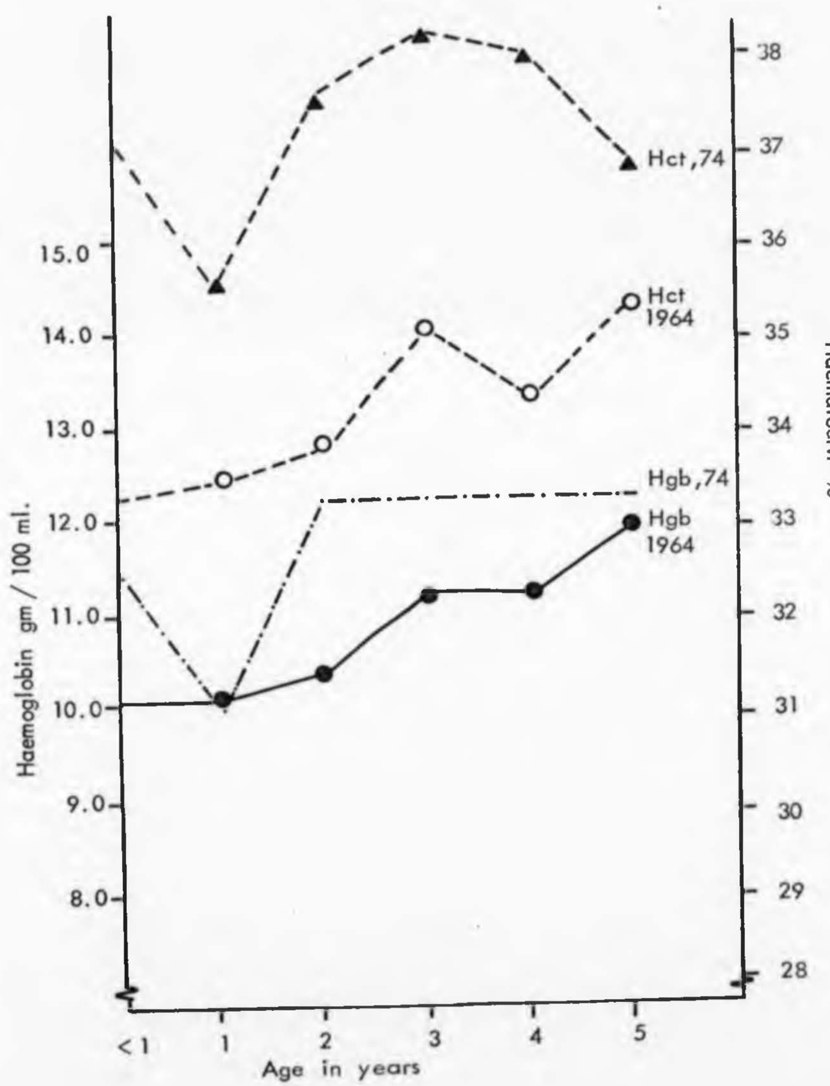


Table 27 shows the haemoglobin and haematocrit values in the well nourished and malnourished children. The 'low' and 'deficient' haemoglobin and haematocrit values were more common among the malnourished children, while the 'high' values were more common among the well nourished group. All the differences were significant at the 1% level.

2. The Clinical Pattern: The main clinical investigations in this chapter were mainly intended to detect some important deficiency signs.

Table 28 shows the per cent prevalence of some clinical signs in males and females. Originally, the clinical signs were classified according to different age periods, but this table became unwieldy and it was decided to put it in the form of total per cent prevalence for each sex.

The most frequent positive clinical findings were as follows:

Mottling of the enamel of the teeth which had an overall prevalence of some 20 per cent, being common after the age of two years. The significance of this finding will be discussed later.

Dental caries was present in 10 per cent of the children, becoming increasingly common from three years onward.

Bossing of the skull and epiphysical enlargement were found in 6 - 10 per cent of the children being most common in the first three years of life.

Table 27

Haemoglobin and Haematocrit Levels in the Two Nutritional Groups

Levels	Haemoglobin		Haematocrit	
	Well nourished Group A	Malnourished Group B	Well nourished Group A	Malnourished Group B
'Low'	1.2	5.8	0.8	4.6
'Deficient'	7.3	11.9	6.4	9.3
'Acceptable'	24.6	46.6	19.9	45.4
'High'	66.9	35.7	72.7	40.7
Chi^2 value	13.284		13.921	
P	< 0.01		< 0.01	

See text for meaning of 'Levels'.

Values are in percentages

Table 28

Percent Prevalence of Clinical Signs

Clinical Sign	No. males: 1922	No. females: 1812
	Percent Prevalence	
	Males	Females
Hair		
Lack of lustre	1.1	1.8
Thinness and sparseness	3.4	5.7
Dyspigmentation of proximals	3.6	6.9
Easily pluckable	2.0	3.8
Pediculosis	0.7	1.0
Face		
Moon face	1.3	0.9
Pallor	2.1	2.4
Eyes		
Xerosis conjunctiva	0.1	0.0
Xerophtalmia	0.0	0.1
Bitot's spots	0.3	0.1
Angular palpebritis	0.8	0.7
Pallor of mucousa	0.4	0.1
Lips		
Angular stomatitis, cheilosis	2.3	2.0
Angular scars	3.9	3.2
Pallor of mucousa	0.6	0.2
Tongue		
Glossitis	0.1	0.2
Atrophic papillae	0.4	0.1

(cont.)

(cont.)

Table 28

Percent Prevalence of Clinical Signs

Clinical Sign	Percent Prevalence	
	Males	Females
Teeth		
Mottled enamel	22.1	20.6
Dental caries	9.6	9.2
Gums		
Spongy bleeding gums	0.3	0.1
Thyroid enlargement	0.0	0.0
Skin		
Xerosis	8.2	7.2
Follicular hyperkeratosis	7.4	7.1
Pellagrous dermatosis	0.3	0.6
Flaky paint dermatosis	0.2	0.2
Muscle wasting and reduced amount of fat	21.2	22.5
Oedema	0.0	0.3
Paetechia	0.0	0.0
Craniotabes	0.5	0.2
Frontal and parietal bossing	9.1	6.8
Epiphyseal enlargement	9.3	7.1
Beading of ribs	1.0	0.4
Knock knees or bow legs	0.9	0.3
Hepatomegaly	0.6	0.6
Splenomegaly	0.0	0.0
Ascites	0.0	0.0
Psychomotor changes (apathy)	0.0	0.1
Calf tenderness	0.0	0.0
Scars	53.0	49.3

Non-specific skin changes - xerosis and follicular hyperkeratosis were found in more than 8 per cent. The prevalence shows some increase after the age of two years. A small number of children (3 - 7 per cent) showed changes in the hair and lips (angular stomatitis).

However, the most significant negative findings (prevalence <1 per cent) were:

Eye signs of vitamin A deficiency (xerosis conjunctiva and xerophtalmia) were seen in only three boys and two girls (an overall prevalence of about 0.15 per cent). The more questionable sign of Bitot's spots was slightly commoner.

Enlarged liver - this was found in 12 male and 11 female children, an overall prevalence of 0.6 per cent. This finding was commonest under two years.

Enlargement of the spleen was not found.

Oedema was present in 3 cases only; 2 of them were in females.

Pediculosis, the presence of which might reflect the standard of hygiene in this community, was examined by eye under the prevailing daylight. It is expected that the present prevalence (about 1 per cent) is underestimated, since it is impossible to diagnose this condition accurately under the conditions prevailing in this study.

3. Morbidity Pattern: The morbidity pattern in this study is considered in terms of per cent prevalence of some common diseases known to be very common in this community and has a direct or indirect influence on growth and nutrition and the pattern of hospitalization and doctors' visits.

The term 'current diarrhoea' or URI means the occurrence of diarrhoea or URI during the last two days; 'recent' means the occurrence of diarrhoea or URI during the last two weeks, and the term 'recurrent' means the occurrence of diarrhoea or URI more than six times during the last six months.
The meanings of the terms diarrhoea and upper respiratory tract infection are listed in the Appendix.

Table 29 shows that 87 males and 47 females were hospitalized during the six months prior to the study time in differnet age periods. There were more children hospitalized during the age period 12 - 18 months; also there were more males hospitalized than females in most age groups.

There were also more males visiting the out-patient department compared with females.

Table 30 shows the percent prevalence of common diseases by age in males and females.

The percent prevalence of current diarrhoea among the total group of males was 12.1 and of females it was 10.7.

There was a gradual decline in the prevalence of diarrhoeal diseases with increasing age in both sexes, as shown in Histogram 3.

Table 29

Recent* Hospitalization and Out-Patient Department Visits

by Age and Sex (All Children)

Age (months)	Hospital		Out-Patient Department	
	Males	Females	Males	Females
	No.	No.	No.	No.
6 - 12	9	4	126	86
12 - 18	15	7	124	126
18 - 24	9	3	124	74
24 - 30	9	2	93	91
30 - 36	5	6	93	91
36 - 42	8	8	97	71
42 - 48	6	5	78	80
48 - 54	12	8	76	61
54 - 60	6	3	49	47
60 - 66	8	3	74	51
Total	87 (65)	47 (35)	934 (55)	778 (45)

Figures in parentheses are percentages

*Recent in this table means the period of six months prior to the study time.

Table 30

PERCENT PREVALENCE OF COMMON DISEASES BY SEX AND AGE (MALES)

Age - months	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	24-27	27-30	30-33
No. examined	81	84	122	107	104	97	97	95	76	94	84
						Percent Prevalence					
Diarrhoea											
Current	20.9	26.1	19.6	23.3	23.0	18.5	9.2	16.8	10.5	10.6	14.2
Recent	18.5	17.8	14.7	24.2	19.2	21.6	19.5	23.1	18.4	11.7	21.4
Recurrent	12.3	21.4	13.1	13.0	7.6	12.3	9.2	13.6	6.5	6.3	9.5
U.R.I.											
Current	33.3	53.5	38.5	40.1	36.5	36.0	36.0	42.1	32.8	25.5	39.2
Recent	23.4	34.5	41.8	42.0	26.9	35.0	35.0	32.6	36.8	28.7	39.2
Recurrent	8.6	16.6	18.0	14.9	16.3	18.5	13.4	12.6	15.7	13.8	22.6
Otitis Media	1.2	10.7	13.1	14.9	10.5	9.2	14.4	16.8	10.5	10.6	13.0
Whooping cough	2.4	10.7	7.3	13.0	9.6	10.3	9.2	8.4	10.5	13.8	7.1
Mumps	0.0	0.0	1.6	3.7	9.6	4.1	13.4	6.3	10.5	7.4	13.0
Chickenpox	1.2	4.7	3.2	3.7	0.9	7.2	7.2	3.1	3.9	3.1	8.3
Measles	6.1	5.9	17.2	22.4	30.7	41.2	40.2	43.1	35.5	45.7	40.4

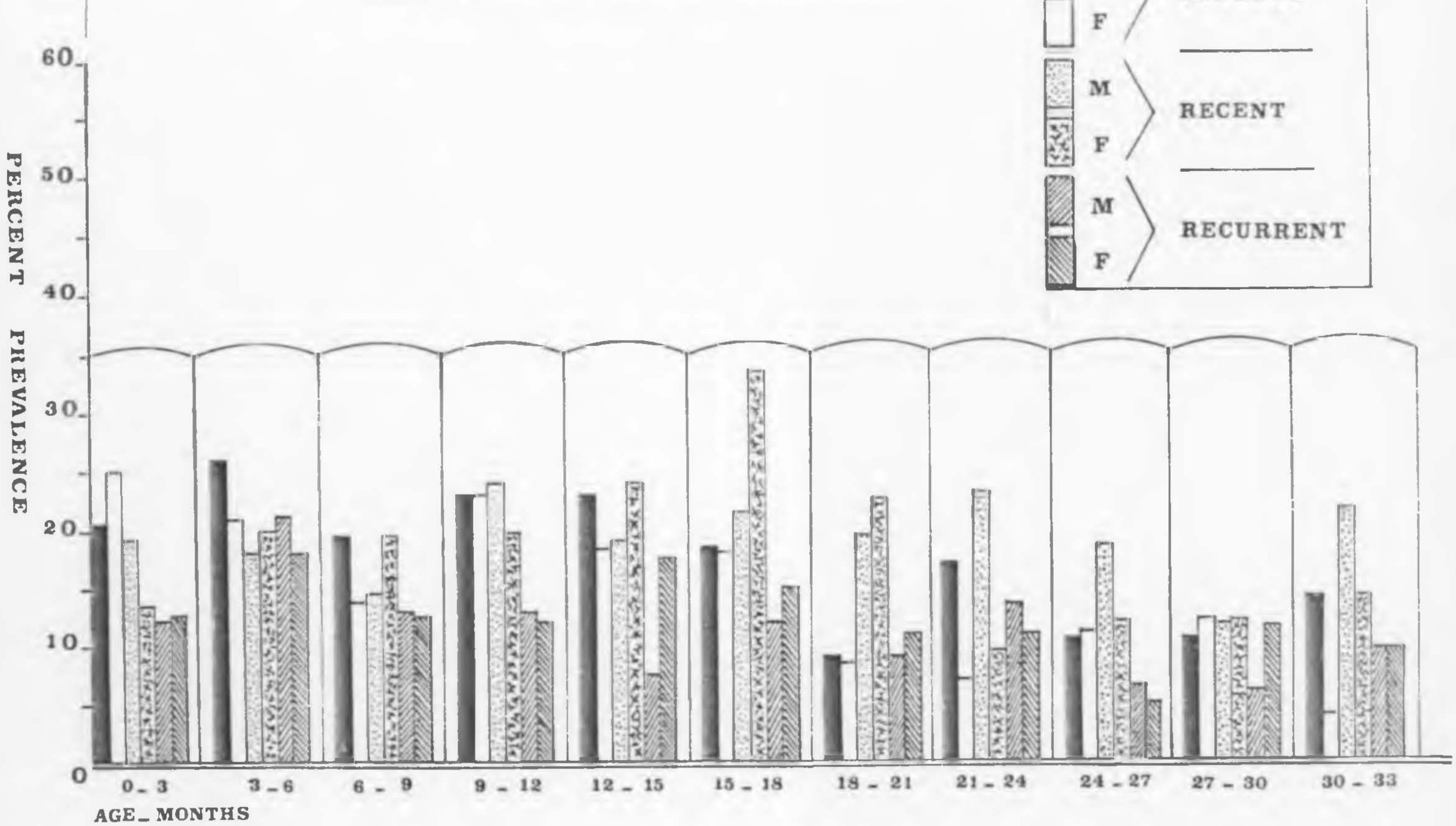
Age - months	33-36	36-39	39-42	42-45	45-48	48-51	51-54	54-57	57-60	60+	Total
No. examined	93	107	78	71	97	80	90	62	65	138	1922
						Percent Prevalence					
Diarrhoea											
Current	7.5	8.4	10.2	4.2	5.1	6.2	2.2	3.2	7.6	2.1	12.1
Recent	10.7	15.8	17.9	9.8	13.4	11.2	13.3	8.0	10.7	12.3	16.1
Recurrent	7.5	8.4	14.1	9.8	8.2	11.2	7.7	8.0	4.6	4.3	9.9
U.R.I.											
Current	24.7	22.4	28.2	18.3	15.4	26.2	25.5	19.3	13.8	24.6	30.5
Recent	31.1	25.2	26.9	33.8	18.5	28.7	28.8	20.9	33.8	28.2	31.2
Recurrent	16.1	18.6	14.1	22.5	11.3	25.0	13.3	17.7	4.6	13.7	15.6
Otitis Media	9.6	4.6	7.6	8.4	4.1	10.0	8.8	1.6	7.6	5.7	9.4
Whooping cough	5.3	15.8	17.9	12.6	10.3	7.4	15.5	12.9	13.8	14.4	10.9
Mumps	8.6	11.1	10.2	12.6	19.5	14.9	13.3	32.2	9.2	11.5	9.7
Chickenpox	4.3	5.6	6.4	7.0	8.2	7.4	4.4	8.0	12.3	14.4	5.9
Measles	49.4	48.5	48.7	64.7	59.7	72.5	67.7	66.1	59.9	71.7	44.1

Table 30

PERCENT PREVALENCE OF COMMON DISEASES BY SEX AND AGE (FEMALES)

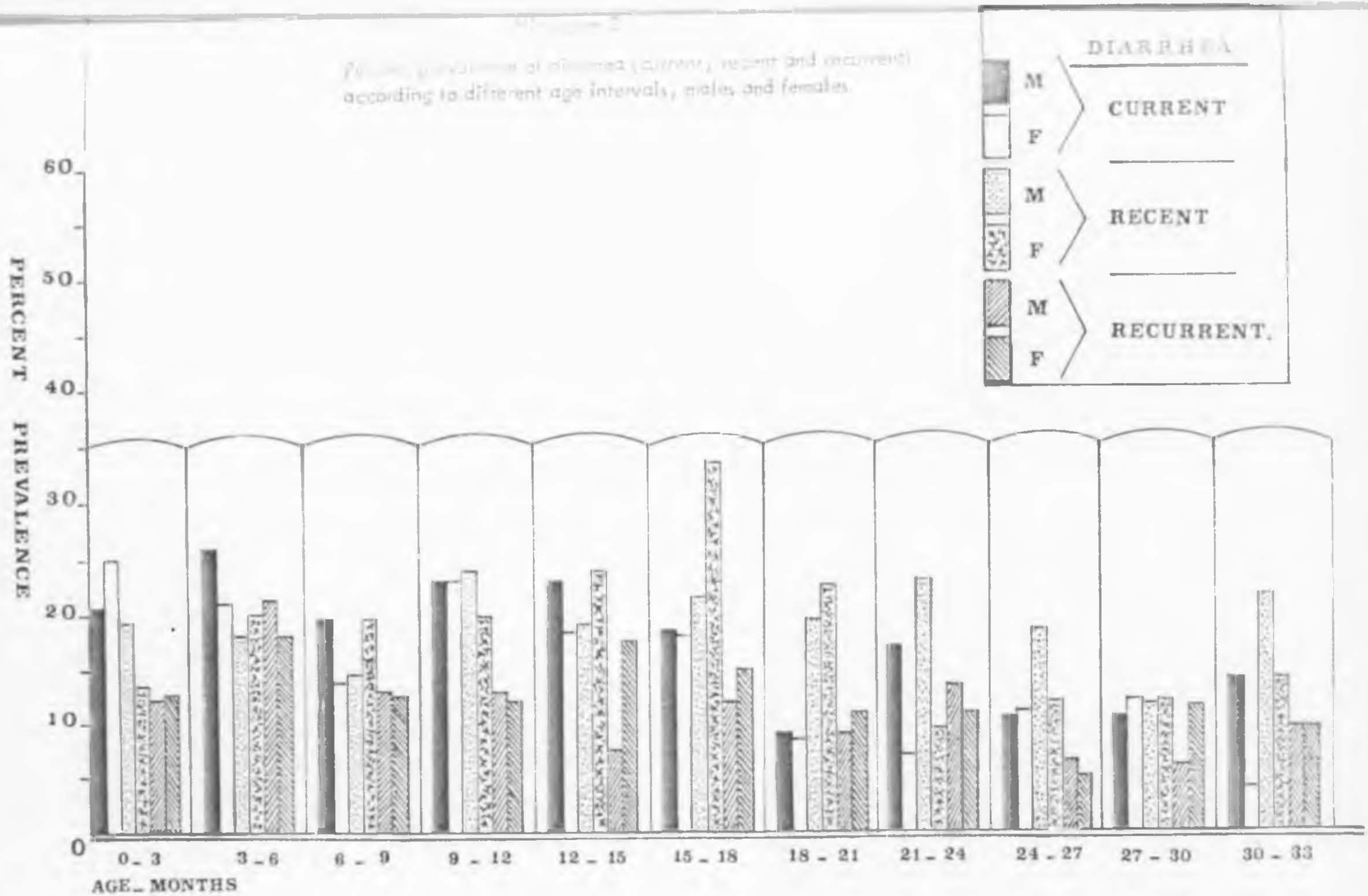
Age - months	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	24-27	27-30	30-33
No. examined	87	96	87	91	96	101	71	83	115	69	92
	Percent Prevalence										
Diarrhoea											
Current	25.2	20.8	13.7	23.0	18.7	17.8	8.4	7.2	11.3	17.3	4.3
Recent	13.7	19.7	19.5	19.7	23.9	33.6	22.5	9.6	12.1	17.3	14.1
Recurrent	12.6	17.7	12.6	12.0	17.7	14.8	11.2	10.8	5.2	11.5	9.7
U.R.I.											
Current	26.4	31.2	40.2	34.0	34.3	30.6	26.7	28.9	26.9	27.5	29.3
Recent	27.5	28.1	40.2	36.2	40.6	34.6	33.8	28.9	27.8	26.0	34.7
Recurrent	9.1	9.3	20.6	18.6	17.7	10.8	23.9	14.4	5.2	17.3.	17.3
Otitis Media	3.4	4.1	17.2	14.2	12.5	10.8	15.4	9.6	8.6	17.3	10.8
Whooping cough	4.5	8.3	10.3	10.9	9.3	13.8	9.8	3.6	8.6	11.5	9.7
Mumps	1.1	1.0	3.4	3.2	6.2	2.9	7.0	8.4	6.0	14.4	9.7
Chickenpox	1.1	0.0	2.2	3.2	5.2	3.9	7.0	3.6	4.3	7.2	8.6
Measles	0.0	9.3	9.1	17.5	26.0	37.6	43.6	43.3	39.1	46.3	41.3

Age - months	33-36	36-39	39-42	42-45	45-48	48-51	51-54	54-57	57-60	60+	Total
No. examined	82	95	72	73	93	86	58	40	67	158	1812
	Percent Prevalence										
Diarrhoea											
Current	9.7	9.4	8.3	5.4	7.5	3.4	0.0	2.5	2.9	1.8	10.7
Recent	12.1	16.8	8.3	12.3	11.8	13.9	3.4	14.9	5.9	8.8	15.2
Recurrent	8.5	9.4	4.1	10.9	9.6	5.8	3.4	2.5	4.4	1.8	9.4
U.R.I.											
Current	24.3	29.4	19.4	32.8	29.0	20.9	22.4	25.0	20.8	22.1	27.9
Recent	21.9	28.4	27.7	26.0	36.5	30.2	15.5	22.5	34.3	27.8	30.4
Recurrent	15.8	13.6	15.2	15.0	18.2	9.3	6.8	10.0	13.4	12.6	13.9
Otitis Media	12.1	14.7	13.8	10.9	6.4	12.7	3.4	10.0	8.9	8.8	10.7
Whooping cough	18.2	16.8	12.5	16.4	22.5	18.6	20.6	10.0	7.4	14.5	12.3
Mumps	9.7	8.4	11.1	10.9	11.8	8.1	12.0	5.0	11.9	9.4	7.5
Chickenpox	8.5	2.1	6.9	5.4	16.1	6.9	10.3	5.0	5.9	8.2	5.7
Measles	48.7	49.4	62.5	53.4	66.6	69.7	72.4	62.5	70.1	67.7	43.7



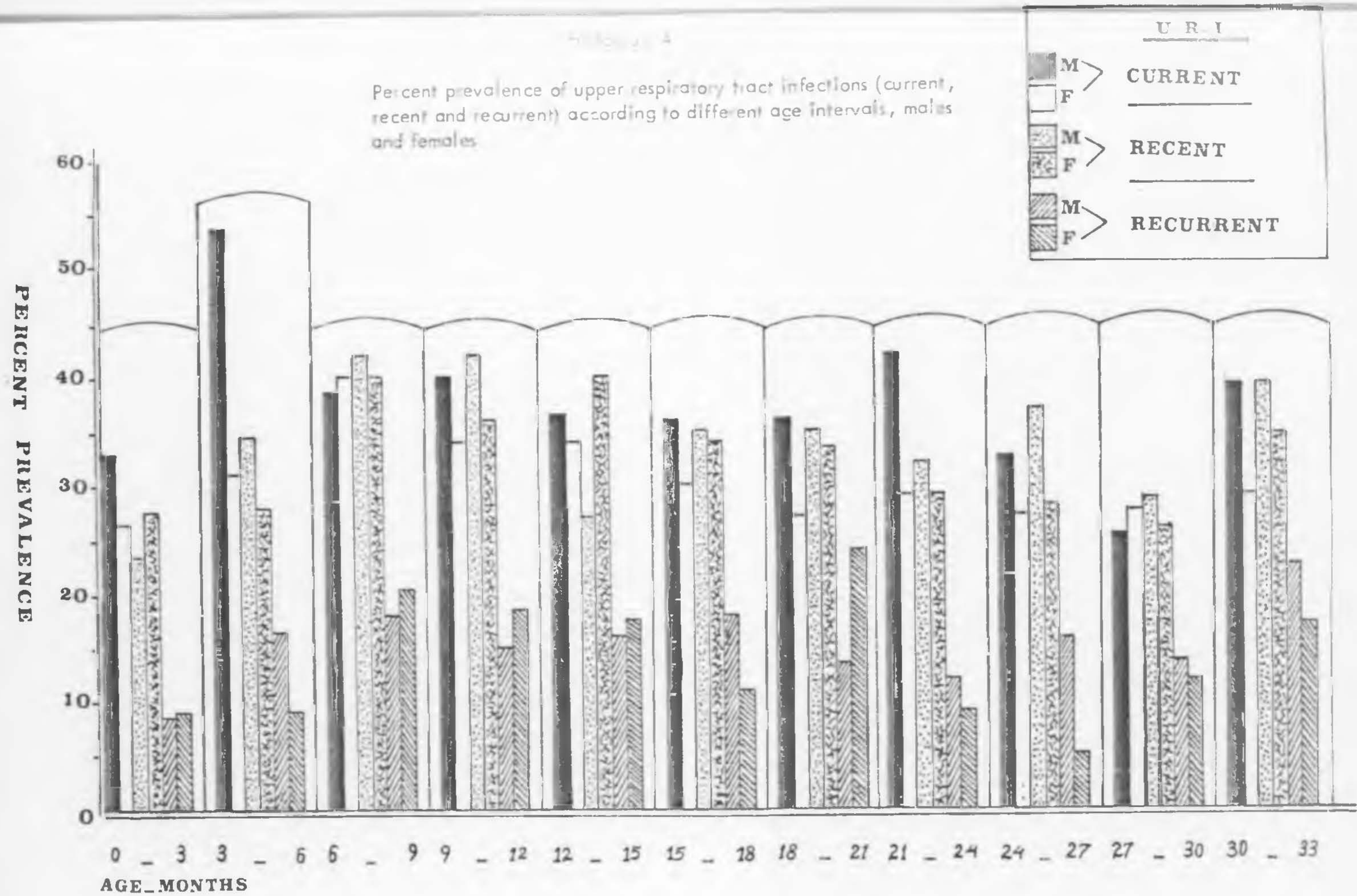
Histogram 3

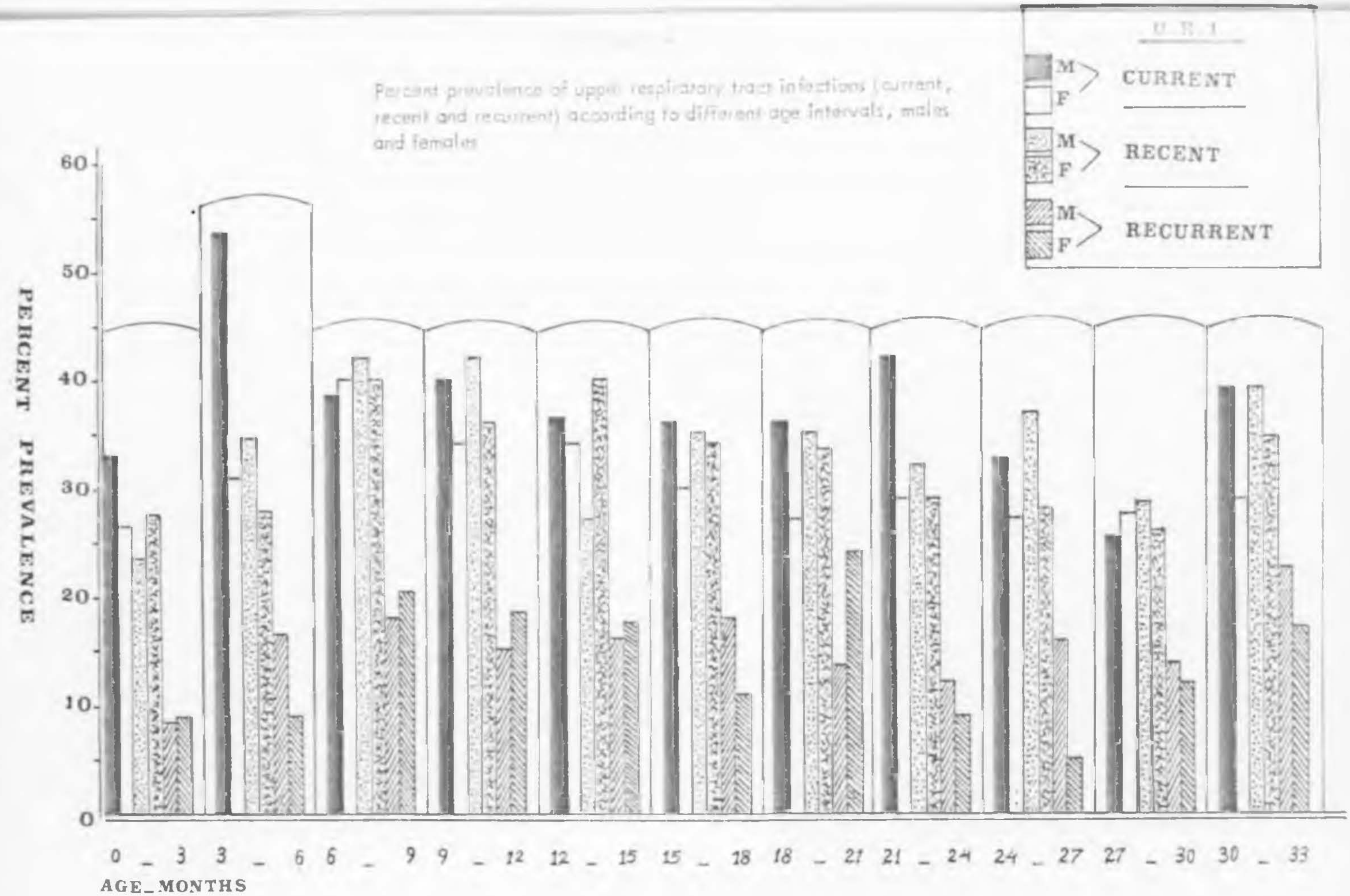
Percent prevalence of diarrhea (current, recent and recurrent) according to different age intervals, males and females



Period prevalence of diarrhea (current, recent and recurrent) according to different age intervals, males and females.

Percent prevalence of upper respiratory tract infections (current, recent and recurrent) according to different age intervals, males and females





Percent prevalence of upper respiratory tract infections (current, recent and recurrent) according to different age intervals, males and females

Recurrent diarrhoea was higher among females especially during the first 18 months of life and reached its lowest attack rate at the age of 60 months.

Upper respiratory tract infections had the highest prevalence among the diseases mentioned in this chapter, just next to measles after the age of 18 months. Unlike diarrhoeal diseases URI were more common in children of older age groups, as shown in Histogram 4.

However, the prevalence of a recent URI was relatively high among almost all the age groups which might suggest that a large part of the community studied had had a URI epidemic prior to the survey. Females, in general, had a higher prevalence of URI.

From our clinical observations, otitis media is known to be very common. The finding in this survey confirms the impression that otitis media had a high prevalence and especially in children during the first 30 months of life, thereafter, it started to decline. The attack rate reached its lowest limits at the age of 54 - 57 months.

Chicken pox was shown to have the lowest prevalence. Chicken pox is known to be a mild disease, and its effect on nutritional status is minimal.

Table 31 shows the numbers and percentages of children who had had attacks of five common diseases according to their nutritional status, and also those who had not. There were no significant differences between the well nourished and malnourished children.

Table 31

Number and Percentage of Children who had had Attacks of Five Common Diseases and those who had not, According to their Nutritional Status and Significance Tests

	Whooping Cough		Chickenpox		Otitis Media		Measles		Mumps	
Disease Pattern	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Had-had the disease	421 (11.6)	7 (10.9)	215 (5.9)	4 (6.2)	367 (10.3)	6 (9.5)	1608 (44.3)	25 (38.4)	319 (8.7)	3 (4.6)
Had not had the disease	3206 (88.3)	57 (89.0)	3417 (94.0)	60 (93.7)	3165 (89.4)	57 (90.4)	2016 (55.6)	40 (61.5)	3311 (91.2)	61 (95.3)
Chi - square value	0.027		0.012		0.050		0.903		1.328	
P	N.S.		N.S.		N.S.		N.S.		N.S.	

Group A: Well nourished children; Group B: Malnourished children

Figures in parentheses are percentages

4. THE SIGNIFICANCE OF SOME POSITIVE CLINICAL FINDINGS

Changes in skin, hair and mucosa are difficult to evaluate quantitatively, and subject to much observer error. Moreover, their nutritional significance is far from clear. These signs were uncommon in the children studied, and will not be discussed further.

There are however, signs which do have a nutritional meaning. These can be divided into two groups:

1. Oedema and enlargement of the liver, which are characteristics of kwashiorkor.
2. Changes such as xerophtalmia, the bony changes of rickets and dental fluorosis which are evidence of specific vitamin or mineral deficiencies.

I Oedema: is accepted as the most important diagnostic feature of kwashiorkor. The various theories of its pathogenesis were discussed by Waterlow and Alleyne (1971). Oedema was present in three cases of the total number examined and this was a rare finding.

II Enlarged liver: Malaria does not occur in Jordan; because of this and in the absence of splenomegaly the most likely cause of enlarged liver in young children in this community is fatty infiltration caused by malnutrition. Present opinion is that this accumulation of fat results from failure of fat transport out of the liver because of a reduced rate of synthesis in the protein part of the lipoprotein molecule (Seakins and Waterlow, 1972; Truswell, Hansen, Watson and Wannerburg, 1969; Flores, Pak, Maccioni and Monckeberg, 1970). Like oedema, enlargement of the liver was a rare finding (12 cases).

III Xerophtalmia and eye signs of vitamin A deficiency: Vitamin A deficiency in Jordan is well documented (ICNND, 1962; ICNND, 1964; Pharaon and Hijazi, 1966; McLaren, 1964; Pharaon, Shammout and Hijazi, 1970). It was shown that the mortality is greatly increased in protein malnourished children if severe vitamin A deficiency is present (McLaren, 1964). The chief manifestations are ocular affecting first the posterior segment of the eye (night blindness) and later, the anterior segment (xerosis conjunctivae) followed by xerosis corneae and ultimately keratomalacia). Bitots' spots and follicular hyperkeratosis are of doubtful significance, unless they accompany the other signs already mentioned (Nutrition Reviews, 1961 and 1963).

It was interesting to find out the low frequency of vitamin A deficiency signs in this study especially when compared with previous reports (ICNND, 1964; Pharaon, Shammout and Hijazi, 1970). There has been more awareness by the medical and para-medical personnel on vitamin A and also on many other preventive measures including fortification with vitamin A and carotene of the vegetable ghee which is widely consumed in Jordan and also through joint education efforts in different concerned ministries. All these factors probably had worked to reduce the signs suggestive of vitamin A deficiency.

IV Vitamin D deficiency (rickets): It was shown in this study that the following signs suggestive of vitamin D deficiency had a relatively high frequency:

1. Frontal and parietal bossing: localized thickening and heaping up of the frontal

and parietal bones of the skull. Bossing may have a nutritional cause, but it can also occur in children with sickle-cell anaemia and appears to be recognized by some communities as a possible familial characterisitc.

2. Epiphyseal enlargement: In the assessment of this sign, allowance was made for the degree of subcutaneous fat present. In wasted persons, the ends of the long bones appear unusually prominent.

To my knowledge, rickets has never been reported in Jordan; however, paediatricians and general practitioners do treat sporadic cases of rickets and there is no clear idea about its prevalence. The results reported in this study might be used as an indication of its presence in this community, a problem which ought to be investigated. Because it is felt that rickets is a potential danger it is worth further discussion.

The epidemiological and dietary aspects of rickets and osteomalacia were reviewed in a joint symposium of the Nutrition Society and the Medical Research Society (1974). The reappearance of rickets in infants and young children in the early 1960's in the United Kingdom drew attention to the possibility of vitamin D deficiency occurring in other vulnerable groups (Stephan, 1975). In this paper, Stephan reviewed the reports from different tropical countries where there is plenty of sunshine. There may be various explanations behind the presence of rickets in these tropical countries. First: there may be a parallel with the disease kwashiorkor which was first described by Williams (1933) and during the next 20 years was recognized and described in more and more countries of the world where it had previously been unnoticed (Stephan, 1975). Secondly, rickets used to be a disease of early childhood. The infant mortality in countries such as India was so high that a large proportion of children died; if they survived, their condition of life improved in that they could then benefit from the open air and sunlight. Thirdly: it has been observed that the clinical and biochemical changes of rickets seem to be supressed in the presence of malnutrition. When children do not grow they do not develop rickets (Waterlow and Vergara, 1956).

Rickets has been reported in Tehran where there is plenty of sunshine, although not in the winter months. The children suffering from rickets belonged to families of the lower socio-economic classes, who live in high-walled, sunless houses. Children are kept indoors for most of the first year of life, and when they go out in the winter they are well wrapped (Salimpur, 1975). In this study cases of rickets in malnourished children would have been missed if they had not had routine X-rays of wrist.

V Fluoride and dental health: It has been shown that a certain level of fluoride consumption - especially, when this is continuous from early childhood - affords considerable protection for both permanent and milk teeth against caries, without exerting any unfavourable influence on the appearance of the teeth (WHO, 1970).

It was shown that mottling is caused by the consumption of drinking water which is too rich in fluoride (more than 2.0 ppm) and when the dentition is permanently exposed to excessive fluoride during the development and calcification of the teeth (Dean, 1954).

Fluorosis and mottling of teeth varies according to the concentration of fluoride in the drinking water from a small number of spots gleaming like mother-of-pearl and hardly differing in colour from the rest of the enamel to larger, brownish spots or signs of serious dental hyperfluorosis with hypoplastic zones and an often quite dark discoloration affecting extensive areas of the enamel of several teeth in the persons affected.

It was shown in this study that a high frequency of fluorosis appeared together with dental caries. This unusual association does not agree with the above mentioned protective action of fluoride and is worth further discussion.

The degree of mottling was shown to run parallel to the fluoride content of the drinking water, but this was not always absolute since, in addition to the fluoride content, the amount of water consumed, i.e. the quantity of fluoride ion ingested, also plays a role (WHO, 1970). It was also shown that when the average annual temperature is high, then, because of the increased water consumption, small fluoride concentration has a more harmful effect on the enamel than it does in the temperate zone, (Galagan and Lamson, 1953). Living and eating habits were also shown to be important; in cases of malnutrition, for example, the enamel has been found to be more susceptible (Schour and Massler, 1949). A change in the drinking water supply (conversion from water with excessive fluoride to fluoride-poor drinking water) causes the mottling to disappear in children born after the conversion (Dean and McKay, 1939) but mottling in already formed enamel is unaffected.

5. DISCUSSION OF CLINICAL AND LABORATORY FINDINGS

1 Morbidity Pattern: The peak prevalence of whooping cough was 17.9 at the age of 39-42 months; this age prevalence in this community is different from other reported ages (Morley 1973) in Africa and other parts of the world. In Africa whooping cough was reported in the first few months of life and probably this is why it was suggested that the whooping cough vaccination should be given during the first month of life.

The prevalence of whooping cough at the age of 15-18 months was 13.8, a relatively high figure which might suggest that this is the age when the contact of the child with other sick children in the community will be more and the maternal immunity will be almost at its lowest level.

Measles, however, was the most common disease among the children of this community. It has an increasing prevalence with increase of age; by the age of 3-4 years almost 75 per cent of the children had already had measles.

The percent prevalence of measles among the males in the age group 6-9 months was 17.2 and among females it was 9.1. This is a relatively high prevalence for this age which confirms the need for measles vaccination campaigns to start at the age of nine months.

Next to measles, diarrhoeal and upper respiratory tract diseases were shown to have the highest prevalence. Diarrhoeal diseases were more common in the weaning age with a less prevalence in the elderly age groups, while upper respiratory tract infections were shown to be more common in the elderly children due to more contact. Diarrhoeal diseases were shown to be more common among female infants which might reflect better care and higher incidence of breastfeeding for male children in this community.

<u>II Assessment of the Nutritional Status by the Use of Clinical Examination</u>: The clinical examination is the simplest procedure that may be employed in the evaluation of childrens' nutritional status; only a trained observer is needed. Therefore, for survey work in the field, clinical examination would appear to be the best approach; one or two physicians with the assistance of a nurse or even an untrained person, can carry out meaningful examinations on as many as a hundred children daily, or even more, as was done in this study. The more detailed the examination, the fewer that can be handled.

Clinical examination is the first of three approaches that have been used in this survey; it is probably the most basic part of the evaluation of children's nutritional status. The other two are anthropometric and haematological evaluation. The two latter methods are to a large extent dependant on clinical examination for the establishment of standards or patterns of evaluation. Before a biochemist with a new test can establish normal or deficient levels, the clinician must tell him which of his test subjects are healthy and which are not. The final decision may rely upon the confirmatory biochemical tests but, ultimately, behind all this lies a clinical decision as to health and disease.

The two extremes of health, good health and severe deficiencies, are easily recognised; it is the other levels of mild to moderate deficiencies that give us trouble.

Because most of our cases were of the mild to moderate type, and there were relatively few with severe forms of malnutrition, we felt that a combination of tests (clinical, anthropometric, dietary and haematologic) were needed.

The clinical examination carried out in this study was moderately detailed. It included some historic information and identifying data, information related to economic status and environmental factors, and also data on disease pattern which may possibly affect the nutritional status, e.g. infections. The clinical nutritional examination of this study included an evaluation of four main areas:

1. Assessment of the growth pattern
2. Search for certain specific physical signs associated with particular deficiencies
3. Estimation of the degree of fatness or leanness
4. General examination of the heart and the presence of hepato-splenomegaly

The assessment of growth is a most important part of a health survey of children. Retardation of growth is a sensitive index of many kinds of disease, although nutritional deprivation is certainly one of the most common causes.

The check list of physical signs of specific nutrient deficiency in this study included special emphasis on vitamins A and D and riboflavin which are thought to be the most important in this community. Also we used a check list of other signs like: pallor of the face, lips and conjunctivaes, dental caries and flourosis, heart murmurs and enlargement of liver and spleen.

The degress of fatness is a measure of sufficiency of calorie intake in relation to requirement. A rough estimate of overweight, normal or underweight can be made by a brief look at an individual; however, the measurements of heights, weights, circumference and skinfold thickness can give more conclusive information.

III Iron Status in the Newborn, Infants and in Young Children: Faeto-maternal transfer of iron via the placenta occurs in the second half of pregnancy (Burman, 1971; Sanchez-Medal, 1969 and Smith, 1959) and the faeto-placental unit is considered capable of obtaining iron from the mother with great efficiency against a concentration gradient (Pochedly, 1968; Pritchard, Whalley and Scott, 1969).

At birth the newborn has higher levels of haemoglobin and serum iron than the mother (O'Brien and Pearson, 1971) but lower total iron binding capacity (TIBC). The newborn has in fact a higher haemoglobin than the normal adult, apparently as a consequence of the low oxygen tension in utero which leads to tissue hypoxia and high erythropoetic levels (O'Brien and Pearson, 1971).

It is considered that the haemoglobin iron constitutes 70-75 per cent of iron legacy of the newborn (Schulman, 1961), and this legacy will be adequate to meet the initial demands of haemoglobin synthesis unless gestation is abnormally short or if the mother is very severely deficient in iron (MacDougall, 1968).

Erythropoeisis in the newborn is greatly reduced during the first 6-8 weeks of life, although some red cell production occurs in this period, the iron present at birth will fulfil the iron requirements of the first months of life (O'Brien, 1971 and Sanchez-Medal, 1969). In the interim, rapid body growth and a concomittant increase in blood volume, coupled with the decreased erythropoeisis, will produce a precipitous fall in haemoglobin (Kripke and sanders, 1970). This haemoglobin fall cannot be prevented by the administration of iron and other haematinics (O'Brient and Pearson, 1971).

In infancy and early childhood, the haemoglobin concentration is influenced by numerous internal and external factors. There may be physiological and pathological dilution and depletion. The first reflects the effects of rapid growth. According to Mackay (1973), the average haemoglobin level of normal infants varies considerably during the first year, falling from 19 gm per 100 ml of blood at birth to 11 gr per 100 ml at one year of age. The physiological change which occurs during the first year of life is thought to be due to two major factors, (Sturgeon, 1956):

1. the dilution of haemoglobin concentration due to a rapid gain in weight with a simultaneous expansion in blood volume

2. The depletion factor which decreases haemoglobin concentration due to the withdrawal of two thirds of its iron component to function in the more vital compound myoglobin in skeletal muscle, which has the same iron content as haemoglobin (3.4 mg/gm).

In the otherwise normal infant who has a reduced haemoglobin at birth (due to maternal and/or foetal factors affecting intra-uterine haematopoesis), the drain of iron from haemoglobin to myoglobin constitutes a significant factor in the aetiology of physiological anaemia of late infancy (6-18 months), (Schulman, 1959).

This anaemia, in contradistinction to the physiological anaemia of early infancy (first three months), responds to iron treatment and is characterised by microcytosis and a low haemoglobin concentration (10.5 - 11.0 gm per 100 ml).

It is associated with evidence of depleted iron reserves in the various compartments (haemoglobin, serum iron, iron binding capacity and iron stores).

With the slowing of growth rate by the end of the first year iron depletion starts to correct itself and in the normal child, physiological anaemia is believed to be of a rare occurrence after the second year of life; this finding was confirmed when looking at the levels of haemoglobin and haematocrit of male and female children in the age group 6 months to 24 months in this study. Two main factors might be responsible for the drop of haemoglobin and haematocrit in this age interval: the depletion of maternal stores together with poor dietary intake during this period and the added effect of increased requirements due to the rapid growth and also the superimposed infections.

It was clear that haemoglobin values were significantly lower among the malnourished children ($P < 0.01$). Protein, like iron, is an essential constituent of haemoglobin. The presence of protein in adequate amount and quality is a basic pre-requisite for the absorption, transport and utilization of iron in the haemoglobin synthesis and storage. It was shown that in countries (Ingenbleck et al. 1975) where nutritional anaemias are common in apparently healthy and in protein-deprived children, the malnourished were mostly affected. It was shown also (Ingenbleck et al., 1975) that in protein energy malnourished children, iron deficiency plays a major role in the appearance of this nutritional anaemia, and the increased level of transferrin which reflect a compensatory mechanism might constitute a reliable index for assessing the severity of iron deficit. This condition becomes more clear when protein replenishment is achieved.

a. <u>Mothers' Weights and Heights:</u> Mothers' weights and heights according to different age intervals are shown in Table 32, 33 and figure 4 . Measurements of pregnant women were excluded. The mother's weight showed a tendency to increase consistently. However, the mean height did not show any such variation.

Table 34 shows the maternal mean heights and weights in the two nutritional groups*. The mean weight of mothers of the well nourished children were significantly ($P < 0.05$) higher; while the height difference was not significant.

The pattern of the increasing weighr of the mothers with increasing age and parity in this study resembles that found in the developed industrial countries, where women become heavier as both their age and family size increase (Morley, 1968).

It is well known that nutritional deprivation in childhood may cause permanent retardation of growth in height, especially if the deprivation occurs when the bones are in the process of rapid growth. Thus the height of the adult may be an indication of his nutritional state during childhood. It was found that the mean maternal heights of the two groups were not different and so their earlier nutritional experience must have been similar. However, body weight at a given height is an indication of the contemporary state of nutrition; the fact that mothers of the well nourished children were significantly heavier than the mothers of the malnourished children suggests that the difference in nutrition extends throughout the families.

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*See Chapter VI for the definition of the nutritional groups.

Genetic factors which may have influenced the heights and weights of the mothers in this study were unknown; but it is our impression, especially when we look at the table on consanguinous marriage (60 per cent of the parents are first and second degree cousins) that genetic influences were probably less significant than in more heterogenous communities.

The fathers' measurements were not taken; such measurements would have been valuable as a reference for this study especially since we know in this community that fathers are the last to suffer. However, similar studies have shown that measurements of fathers of well and malnourished children were not different (Morley, 1968).

Table 32

MOTHER'S WEIGHT (Kg) BY AGE

Age (Years)	No.	Mean	S.D.
Less 15	2	53.375	4.065
15 less 20	180	56.905	7.636
20 less 25	653	58.737	7.895
25 less 30	1022	61.188	10.377
30 less 35	736	63.295	11.415
35 less 40	527	65.673	11.657
40 less 45	264	67.428	12.468
45 less 50	76	67.464	11.535

Table 33

MOTHER'S HEIGHT (Cm) BY AGE

Age (Years)	No.	Mean	S.D.
Less 15	2	155.200	2.262
15 less 20	175	154.803	5.212
20 less 25	633	154.734	4.703
25 less 30	992	155.229	5.005
30 less 35	714	155.353	4.903
35 less 40	512	155.090	4.759
40 less 45	262	155.701	5.239
45 less 50	71	155.671	4.694

Table 34

MATERNAL MEAN WEIGHTS AND HEIGHTS IN THE TWO NUTRITIONAL GROUPS

	Group A	Group B	P
Maternal mean weight (Kg)	63.1	57.7	<0.05
Maternal mean height (cm)	156.2	155.01	N.S.

Figure 4 : Maternal weights and heights according to age

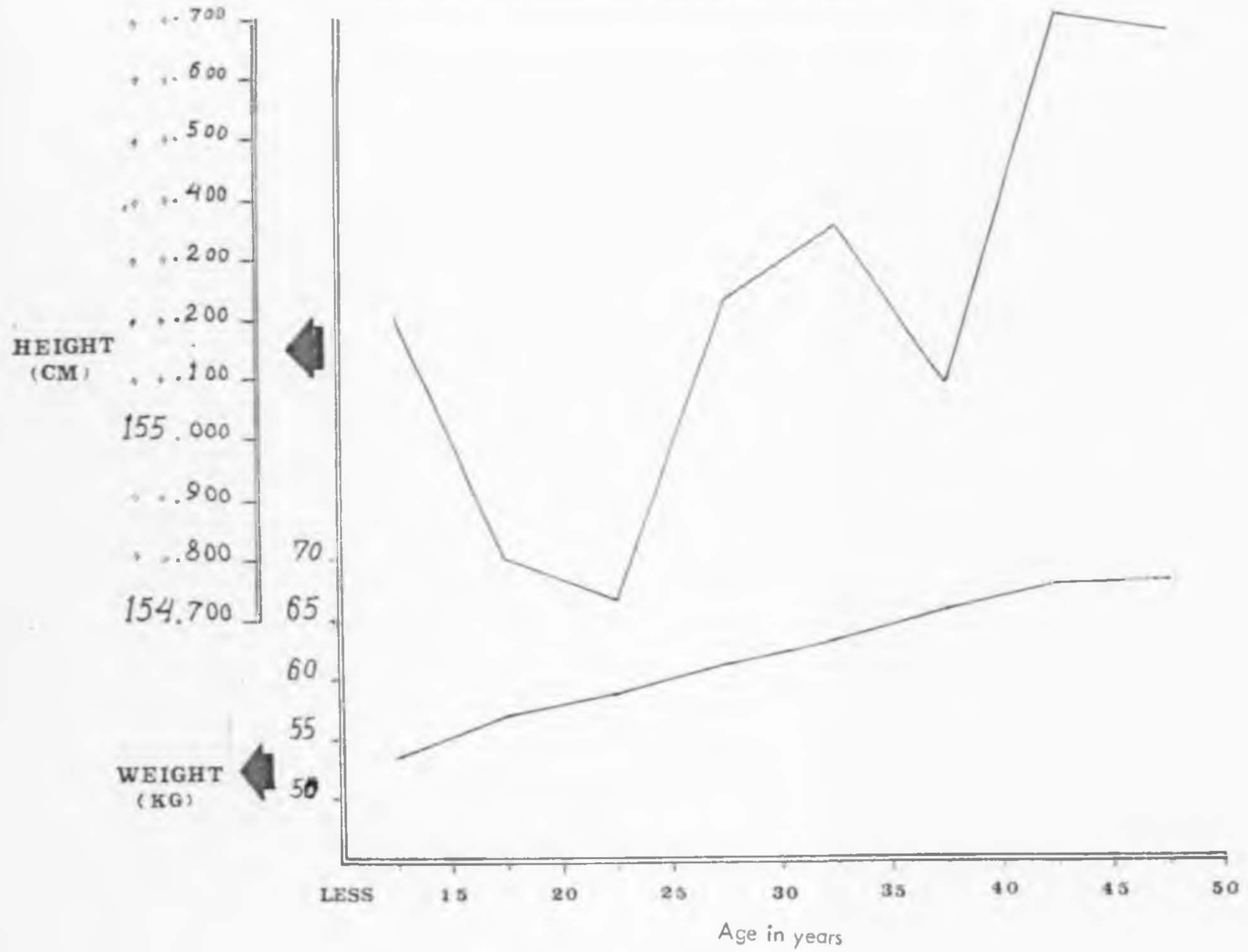
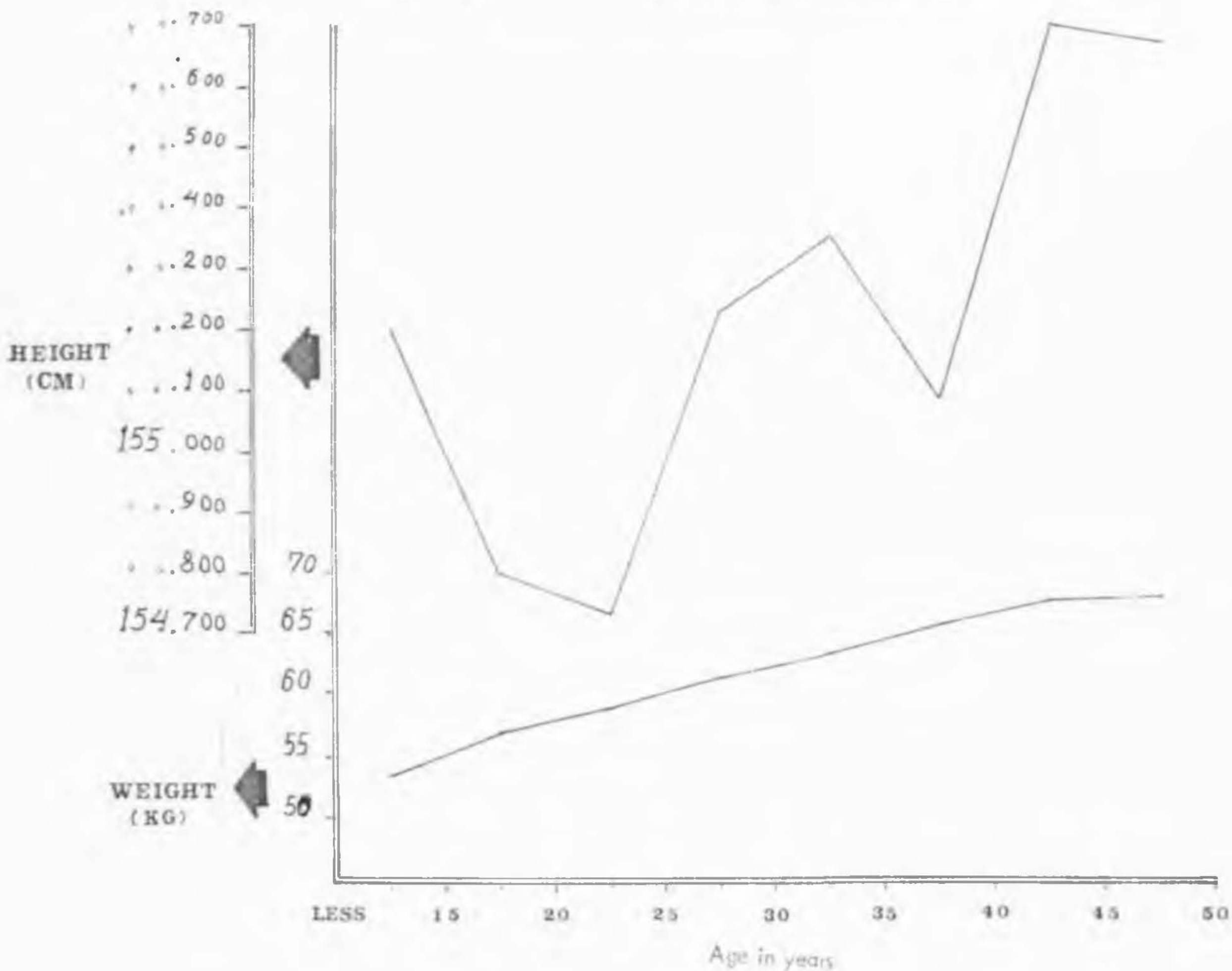


Figure 4 : Maternal weights and heights according to age



b. Body Measurements at Birth: Birth measurements almost entirely reflect the action of the uterine environment and thus depend only on maternal factors (Tanner, 1962). Although some of these factors are genetic and some are environmental in origin (McKeown and Record, 1954; Morton, 1955; Robson, 1955), the genotype of the child has little effect at this stage. Later, however, the child's genotype exerts a greater and greater effect, and the resemblance to the adult status of the parents becomes increasingly marked. For the proper assessment of the initial state of growth at birth, knowledge of birth weight and length is important. In this study the measurements were made on 765 newborn children. These were not taken by the team of the study directly; we used measurement data obtained from a series of consecutive deliveries achieved by the Division of Home Deliveries of the School of Midwifery from seven areas of the lower-middle class in Amman city. A short introduction and orientation course on the proper measurement techniques were given to the class in charge of carrying out these deliveries.

The babies in this series were healthy liveborn singletons with no congenital deformities considered likely to influence their measurements.

The ages of the mothers varied between 15 and 40 years. The mean blood pressure was:

systolic 118 ± 9 mm Hg. (S.D.) (range 90-180)

diastolic 77 ± 7.7 mm Hg. (S.D.) (range 30-100)

141 boys and 132 girls had the right occipito-anterior foetal position; 205 boys and 225 girls presented in the left occipito-anterior position.

The mean haemorrhaegic loss as a result of labour was 124.8 ml $\pm$ 75 (S.D.)

The data does not permit association between body measurements of the new-born infant and maternal factors except for age.

At birth, male infants had a mean birth weight of 3340 gm. This was higher than the only reported figure for Jordan (1964) which was 3300 gm in the 1962 study from hospital deliveries.

The mean birth weight of females was 3230 gm which was also higher than the 1962 figure which was 3180 gm. Table 35 shows the mean birth weights in different studies.

At birth, male infants had a mean length of 49.8 cm and females of 49.2 cm. Table 36 shows the mean birth length in different studies.

Tables 37 and 38 show the birth weight and length distribution of males and females. (Figures 5 and 6).

Table 39 shows the mean and standard deviations of weights and heights according to the mother's age.

Mothers in the age group 30-35 years had longer babies and mothers in the age group 25-30 years had relatively heavier babies.

Table 40 shows the period of time in days for the appearance of colostrum; between the fifth and sixth days almost all the women had their colostrum appearing. The mean time was 2.7 $\pm$ 0.72 days.

Table 35

THE MEAN BIRTH WEIGHT VALUES IN DIFFERENT COMMUNITIES

Community	Author	Year	Mean birth weight (Kg)	
			Male	Female
Jordan	Hijazi, S.S.	This study	3,340	3,230
Jordan	ICNND, ICNJ	1964	3,300	3,180
Egypt	Abbassy et al.	1972	3,420	3,340
Lebanon	Harfouche	1966	3,410	3,330
USA	Green & Richmond & Nelson et al.	1965	3,400	3,360
England	Ellis	1956	3,440	3,320
	Falkner et al.	1958	3,360	3,270
West Indies	Aschroft et al.	1966	4,100	3,700
Sweden	Karlberg et al.	1968	3,400	3,400
Anguilla	Aschroft	1966	3,400	3,900

Table 36

THE MEAN BIRTH LENGTH OF MATURE BABIES IN DIFFERENT STUDIES

Community	Author	Year	Mean birth length (cm)	
			Male	Female
Jordan	Hijazi, S.S.	This study	49.80	49.20
Jordan	ICNND, ICNJ	1964	49.90	49.70
Egypt	Abbassy et al.	1972	50.77	50.18
Lebanon	Harfouche	1966	50.10	49.50
USA	Nelson et al. (Harvard)	1965	50.60	50.20
Sweden	Karlberg et al.	1968	51.00	50.20

Table 37

BIRTH WEIGHT DISTRIBUTION BY SEX FOR LIVEBORN SINGLETON - AMMAN DISTRICT

	Males			Females			Total		
Birth Weight (gm)	No.	Percent	Cum. P/T*	No.	Percent	Cum. P/T*	No.	Percent	Cum. P/T*
2000 - 2500	5	1.2	1.2	1	0.2	0.2	6	0.7	0.7
2500 - 3000	25	6.3	7.6	28	6.9	7.2	53	6.6	7.4
3000 - 3500	144	36.8	44.5	173	43.1	50.3	317	40.0	47.4
3500 - 4000	139	35.5	80.0	134	33.4	83.7	273	34.4	81.9
4000 - 4500	59	15.0	95.1	49	12.2	96.0	108	13.6	95.5
4500 - 5000	16	4.0	99.2	12	2.9	99.0	28	3.5	99.1
5000 - 5500	3	0.7	100.0	4	0.9	100.0	7	0.8	100.0
Total	391	100.0	100.0	401	100.0	100.0	792	100.0	100.0

*Cum./PT = Cumulative Percent

Table 38

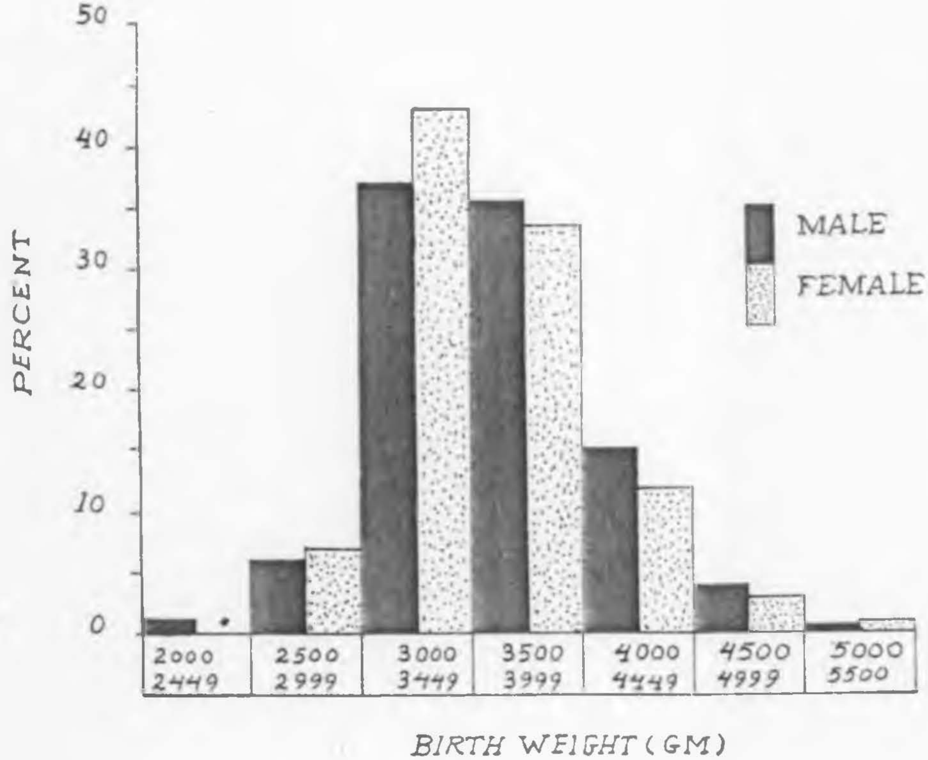
BIRTH LENGTH DISTRIBUTION BY SEX FOR LIVEBORN SINGLETON - AMMAN DISTRICT

	Males			Females			Total		
Birth Height (cm)	No.	Percent	Cum P/T*	No.	Percent	Cum P/T*	No.	Percent	Cum P/T*
41	6	1.6	1.6	6	1.5	1.5	12	1.5	1.5
42	0	0.0	1.6	2	0.5	2.1	2	0.2	1.8
43	1	0.2	1.8	5	1.3	3.4	6	0.7	2.6
44	22	5.8	7.7	32	8.4	11.8	54	7.1	9.8
45	1	0.2	8.0	1	0.2	12.1	2	0.2	10.0
46	1	0.2	8.2	4	1.0	13.1	5	0.6	10.7
47	34	9.0	17.3	29	7.6	20.8	63	8.3	19.0
48	16	4.2	21.6	16	4.2	25.0	32	4.2	23.3
49	249	66.4	88.0	249	65.6	90.7	498	66.0	89.3
50	33	8.8	96.8	24	6.3	97.0	57	7.5	96.9
51	12	3.2	100.0	11	2.9	100.0	23	3.0	100.0
Total	375	100.0	100.0	379	100.0	100.0	754	100.0	100.0

* Cumulative Percent

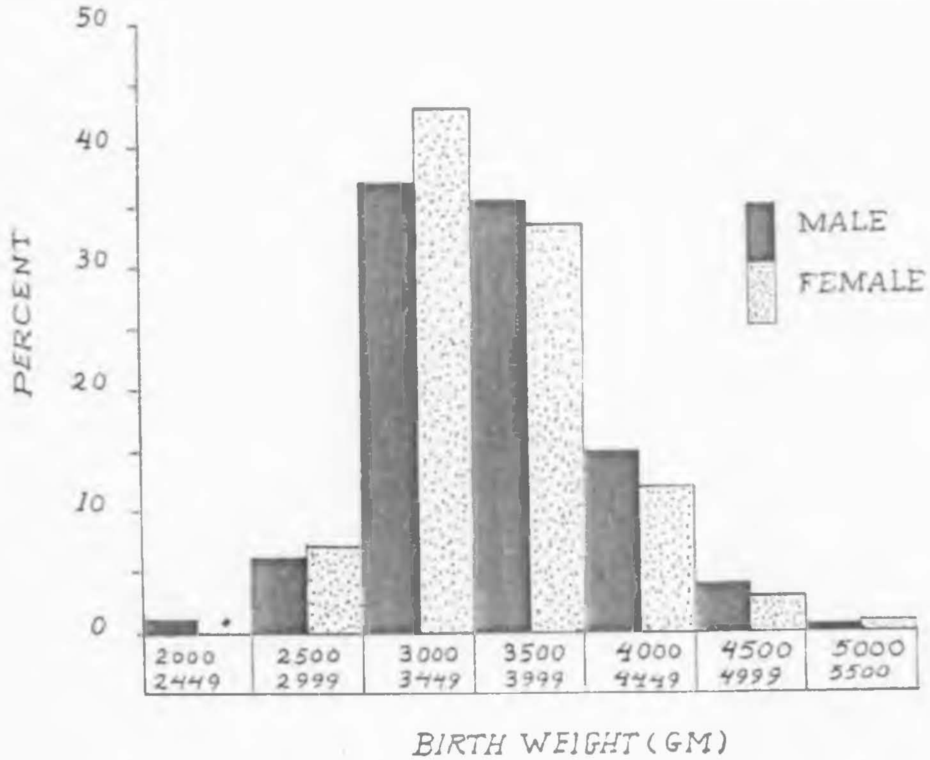
Histogram 5

percent distribution of birth weights of live born singletons, males and females



Histogram 5

percent distribution of birth weights of live born singletons, males and females



Histogram 8

percent distribution of birth lengths of live birth singletons, males and females

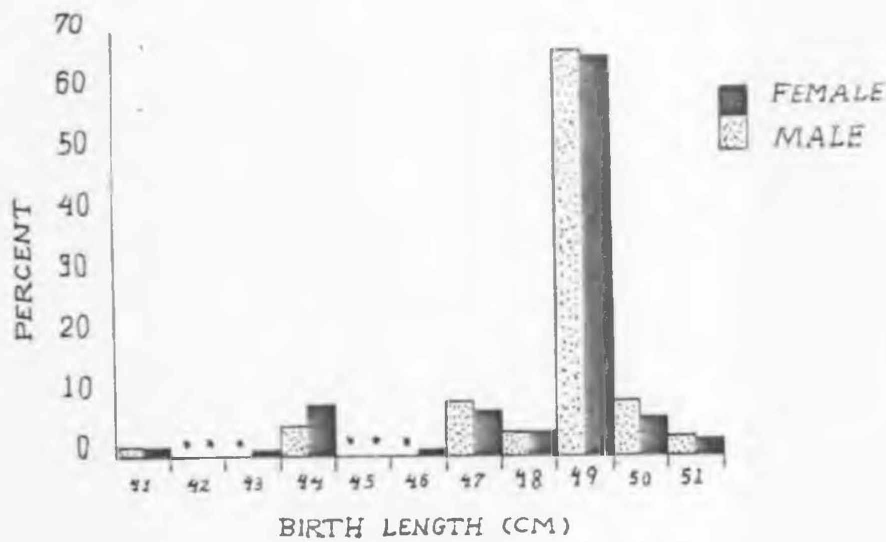


Figure 6

percent distribution of birth lengths of live birth singletons, males and females

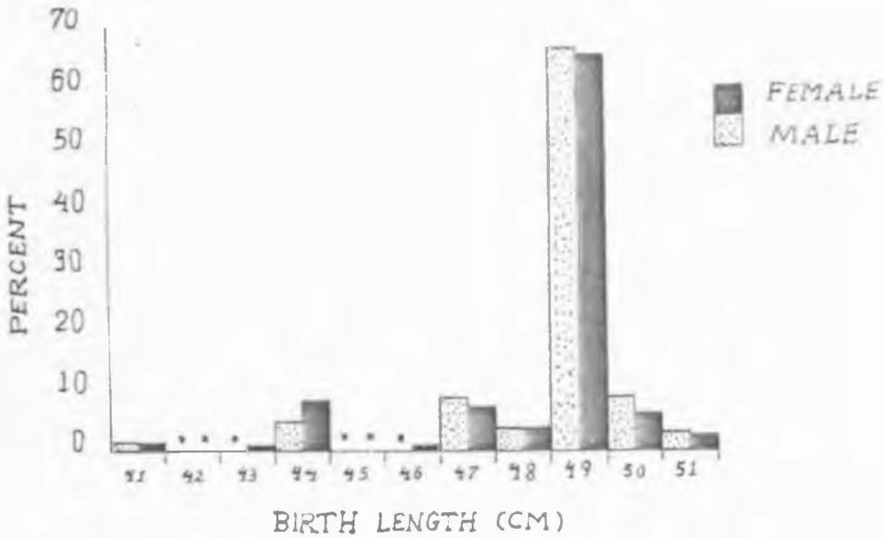


Table 39

MEAN AND S.D. OF BIRTH HEIGHT AND WEIGHT FOR LIVEBORN SINGLETON

ACCORDING TO MOTHER'S AGE - AMMAN DISTRICT

Age Group	Height				Weight			
(Years)	No.	Mean	S.D.	S.E.	No.	Mean	S.D.	S.E.
15 - 20	296	49.077	2.499	0.145	309	3.500	0.503	0.028
20 - 25	255	49.596	2.112	0.132	265	3.561	0.602	0.037
25 - 30	137	49.897	2.066	0.176	140	3.584	0.560	0.047
30 - 35	61	50.245	1.699	0.217	61	3.579	0.416	0.053
35 - 40	16	49.562	1.412	0.353	16	3.434	0.398	0.099
40 - 45	0	0.000	0.000	0.000	0	0.000	0.000	0.000
45 - 50	0	0.000	0.000	0.000	0	0.000	0.000	0.000
Total	765	49.500	2.251	0.081	791	3.540	0.540	0.019

Table 40

TIME OF COLOSTRUM APPEARANCE

Col. Appear. (Day)	No.	Percent	Cum P/T*
1	49	6.5	6.5
2	181	24.0	30.5
3	477	63.4	94.0
4	38	5.0	99.0
5	5	0.6	99.7
6	2	0.2	100.0
7	0	0.0	100.0
8	1	0.1	100.1
Total	752	100.0	100.0

No.	Mean	S.D.	S.E.
752	2.700	0.716	0.026

*Cumulative Percent

<u>Discussion of Birth Measurements</u>: The close relationship between maternal nutritional status on the one hand and the health of the pregnant woman and her offspring on the other, has been the subject of several reports (Jelliffe, 1955; Williams, 1962; Gordon, 1962; WHO, 1965). It is known that an ample diet during pregnancy will ensure optimal foetal storage, and in addition a heavier and probably more mature baby, possibly with a bigger 'protein reserve' in the form of well developed muscle tissue (Jelliffe 1965). It has also been shown that there is a positive association between levels of calorie supplementation during pregnancy and birth weight; however in the Guatemalan study there was no significant difference in the effect of a calorie and a protein and calorie supplement, (Lechtig, Habicht, Yarbrough Delgado, Guzman and Klein, 1975).

The effect of maternal malnutrition and starvation on the health of the newborn has also been extensively studied. It was shown that the state of malnutrition might limit foetal growth (Oborndorfer, Mejia and Del Valle, 1965). This is probably due to slowing of foetal growth to adapt to prenatal malnutrition.

Short term starvation in previously well-nourished mothers may cause amenorrhoea, small weight gain or actual weight loss during pregnancy; but it does <u>not</u> affect foetal nutrition to the same extent as in laboratory experiments (Chandra, 1964; Smith, 1962).

The infants born in Holland during or right after the 1945-1946 'Hunger Winter' period showed a reduction of about 200 gm in birth weight. Smith (1947) attributed the smallness of this loss to the length of gestation and slow growth of the human foetus as compared with other mammals.

Studies on animals have revealed extensive damage to the offspring resulting from various forms of dietary restriction, particularly restriction of total dietary intake (Chow and Lee, 1964; Simonson, Stephan, Hanson and Chow, 1971; Hsueh, Agustin and Chow, 1967; Chow, Sherwin, Hsueh and Blackwell, 1969). These permanent effects are poor survival and stunted growth, (Hsueh, Blackwell and Chow, 1970) and unstable behaviour response (Hanson and Simonson, 1971). Subsequent ad libitum feeding does not alleviate the effects.

There is a very large bulk of experimental work on this subject which cannot be mentioned here, because this study was concerned only with human infants. Moreover, application of animal results to man is difficult because of the different timing of growth, particularly brain growth, in relation to birth (Dobbing, 1974).

The second most important factor which might influence the growth of the foetus is related to the function of the placenta in limiting the availability of food materials. Rumbolz and McGoogan (1953) believed that a small placenta reduced in surface area by multiple infarcts could be responsible for the small under-nourished full-term infant; they considered the possibility that hypertension or toxemia of the mother leads to poor placental development.

Warkany et al. (1961) suggested that infections (i.e. mumps, rubella), chemicals (sodium aminopterin, myleron) and X-rays during pregnancy probably limit placental function and may lead to foetal undernutrition.

Two useful measures of reproductive efficiency are birth weight and perinatal mortality. The birth weight of the children in this part of the study was satisfactory; however, the figures presented in the Chapter on mortality reveal a high stillbirth rate, which might also reflect the level of obstetric and paediatric care in this community. When these services are provided at a high standard, with healthy young primagravidae, the perinatal death rate is as low as 10 per 1,000 births (WHO, 1961). Where environmental conditions are less favourable, perinatal death rates rise, birth weights are lower at all stages of gestation and premature onset of labour is more common. Under such conditions it seems likely that the higher incidence of babies weighing 2500 gm or less is associated more with deficient growth of the foetus rather than with chronologically premature birth.

If we assume that the birth measurements we have are for children from the lower-middle class, then it is safe to say that children from the higher socio-economic strata might have higher figures. Backwin and Patrick (1944) showed that American negro mothers in higher income groups produced larger babies than those who were of poorer socio-economic status. In many parts of Africa it has been found that negro babies weigh less at birth than European babies (Salber, 1955 and Welbourn (a) and (b), 1955). A social class difference in birth weight has also been found in the United Kingdom (Drillen, 1969).

On the average, women from a favourable environment are taller than those from one less favourable which suggests that the latter have not grown to full capacity (Tanner, 1962). Since there seems to be a correlation between height of the mother and birth weight of the baby, some of the variance in birth weight related to different socio-economic background could be explained on the basis of this observation (WHO, 1961).

In this study the difference between the sexes in mean birth weight is consistent with findings reported by others. At birth, males have generally been found to be slightly bigger than females (Backwin and Backwin, 1974; Cates and Goodwin; Levin, Mackay, Neill, Oberholzer and Whitehead, 1959).

c. ANTHROPOMETRY OF 0-12 MONTH OLD CHILDREN

Anthropometry in Children from 0-12 Months: Growth was described by the following measurements: weight, height, ratio of weight to height (Kg/cm), head circumference, arm circumference and skinfold thickness (triceps, biceps, subscapular and suprailiac).

Because growth during the first year is so important, the measurements have been divided into one month intervals. The results have been analysed separately for the two sexes, and also for both sexes combined. Full tables giving mean, range, standard deviation, standard error and coefficient of variation are collected together in the appendix. These tables are summarized in the text, giving only means and standard deviations, with the values rounded off. These tables will serve as a baseline for future surveys.

Curves are also presented, showing the mean, 3rd, 10th, 25th, 50th, 75th, 90th and 97th centiles. These curves are useful for rapid evaluation of the growth pattern.

Skinfold measurements reported in this section were recorded to supplement weight, length, head and arm circumference measurements in determining the growth pattern and nutritional status of the observed children.

Measurements recorded are absolute values, and no attempt was made to transform them into a logarithmic scale. The skewed character of the distribution can be seen in the wide range of variation of individual measurements.

Weight and height during the first year of life increased steadily. The range of weights showed large variations, especially during the first month of life, which might indicate heterogenicity of this group. The maximum body weight of the males, 9.7 Kg, during the first month suggests an error in measurement, or the possibility that an older child was examined in place of his 0-1 month old brother.

Male children showed higher weights all through the first year of life. At the age of one year the mean weight of males was 8.7 Kg and of females 8.1 Kg. Height and head circumference showed a similar but also marked sex difference. Throughout the first year weight/height ratio was greater in the males.

The coefficient of variation $\frac{\text{S.D.}}{\text{mean}} \times 100$ which was suggested by Kornfeld (1957) as an index of individual variations in the comparative analysis of all measurements in different sexes, age periods and population groups was used in all the measurements taken in this study.

Table 50 shows the coefficient of variation of anthropometric measurements average of monthly values during the first year of life. Head circumference and height which represent the skeletal part of the body had the lowest variations and hence the lowest coefficient of variation values; while the skinfold thickness and weight which represent the fat and the muscle of the body had the highest values which indicate large variations.

Table 41 shows the weight measurement values; figure 5 shows the children's weight centiles by age and sex.

Table 42 shows the height measurement values; figure 6 shows the children's height centiles by age and sex.

Table 43 shows the weight/height ratio of children according to age and sex.

Table 44 shows the head circumference of the children according to age and sex; figure 7 shows the children's head circumference centiles by age and sex.

Table 45 shows the arm circumference values according to age and sex.

Tables 46 , 47 , 48 and 49 show the mean values of triceps, biceps, sub-scapular and suprailiac skinfold thicknesses according to age and sex.

Table 50 compares the variability of the different measurements, calculated as the coefficient of variation and averaged over the whole of the first year.

Table 41

CHILDREN'S WEIGHT (Kg) BY AGE AND SEX

Age (months)	Males No.	Males Mean	Males S.D.	Females No.	Females Mean	Females S.D.
0 less 1	16	4.578	1.653	19	3.828	0.631
1 less 2	26	4.576	0.909	32	4.242	0.695
2 less 3	39	5.350	0.809	36	4.656	0.743
3 less 4	24	5.995	1.281	35	5.700	1.021
4 less 5	32	6.056	0.923	31	6.111	1.028
5 less 6	28	7.272	1.371	29	6.705	1.035
6 less 7	39	7.083	1.005	25	6.884	0.837
7 less 8	46	7.908	1.297	35	7.537	0.883
8 less 9	35	8.405	1.157	26	7.650	1.320
9 less 10	33	8.136	1.363	36	7.879	0.841
10 less 11	39	8.866	1.281	26	8.249	1.086
11 less 12	34	8.706	1.017	29	8.092	1.055

Figure 5 : Centiles for weight according to age during the first year (males and females)

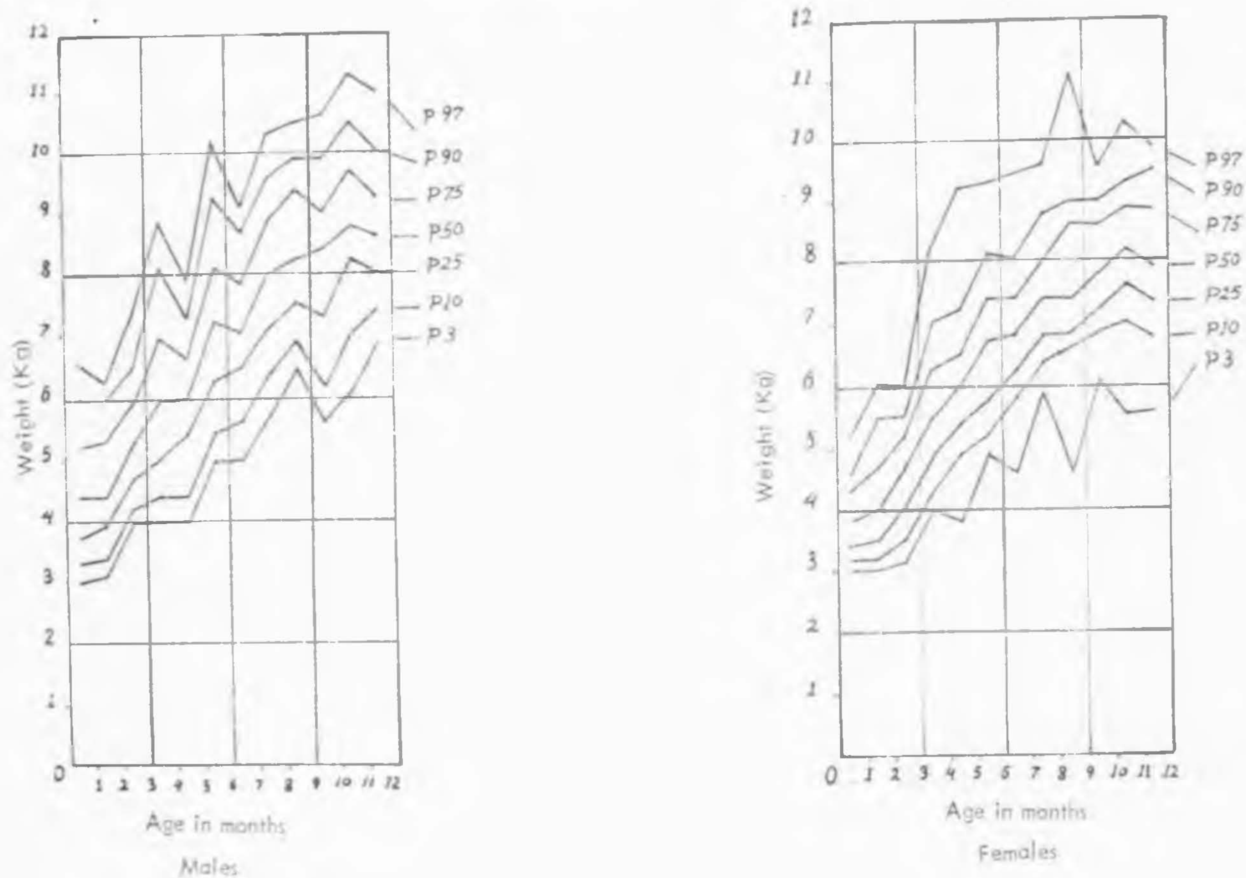
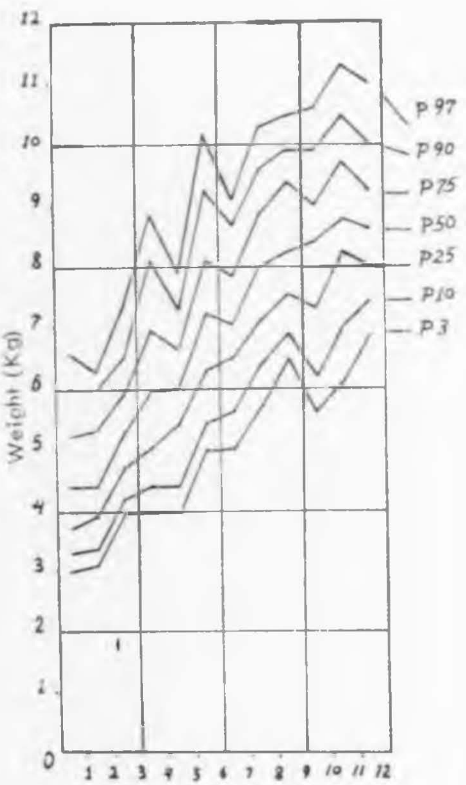
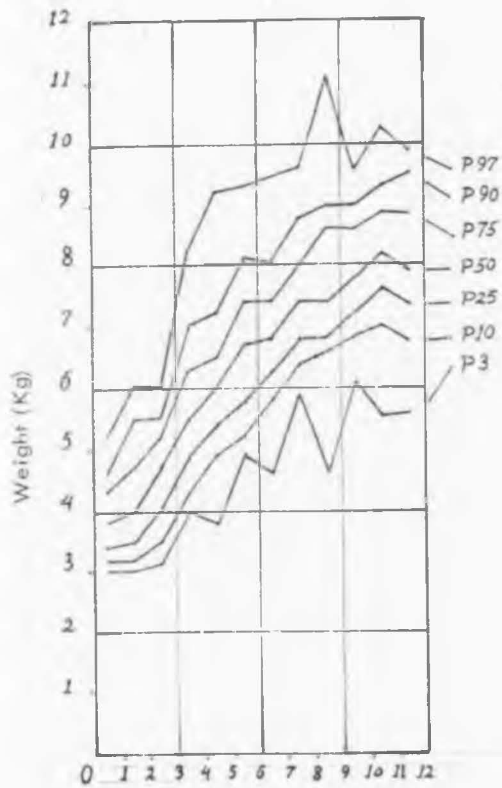


Figure 5 : Centiles for weight according to age during the first year (males and females)

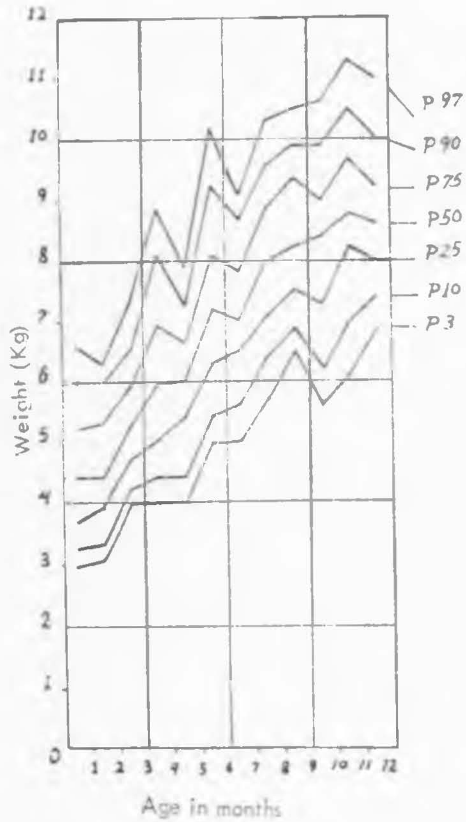


Males

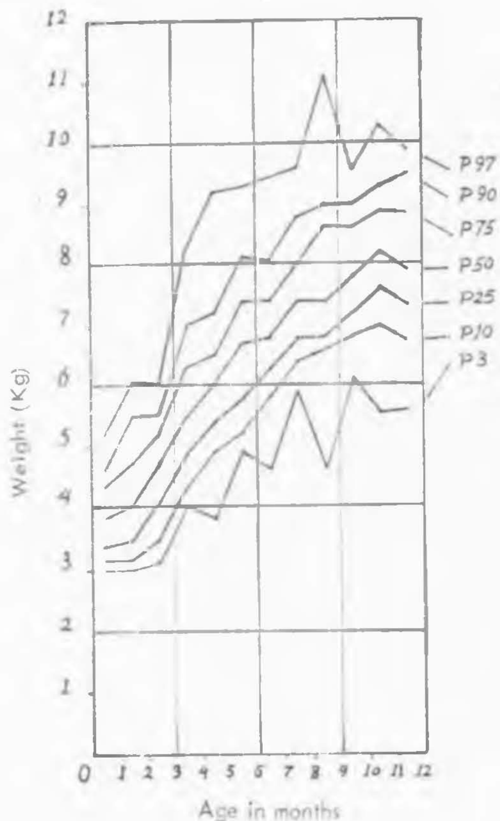


Females

Figure 5 : Centiles for weight according to age during the first year (males and females)



Males



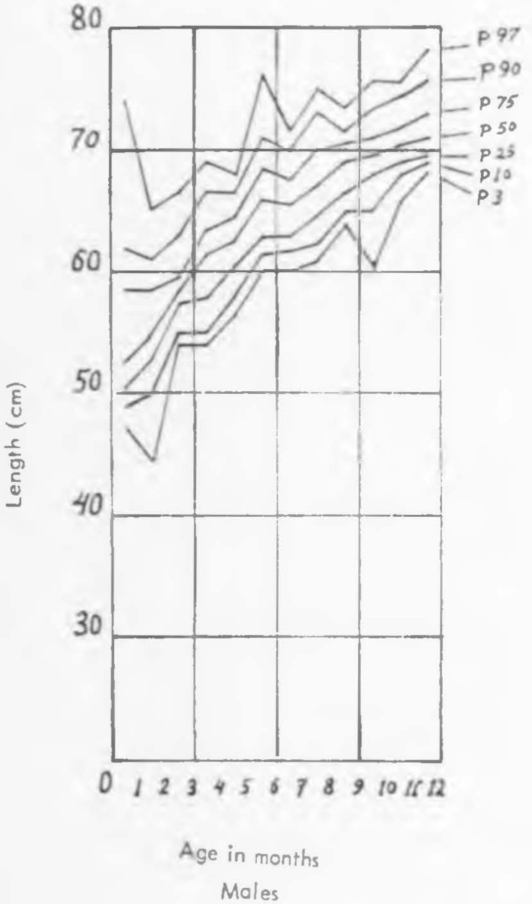
Females

Table 42

CHILDREN'S HEIGHT (Cm) BY AGE AND SEX

Age (months)	Males No.	Males Mean	Males S.D.	Females No.	Females Mean	Females S.D.
0 less 1	16	55.262	4.389	19	52.068	3.841
1 less 2	26	55.007	4.384	32	54.803	2.654
2 less 3	39	58.382	2.951	36	56.252	2.224
3 less 4	24	61.070	4.260	35	59,694	3.030
4 less 5	32	62.500	2.951	31	61.512	2.382
5 less 6	28	66.185	3.892	29	63.279	4.147
6 less 7	39	65.779	3.162	25	64.480	2.406
7 less 8	46	67.834	4.783	34	65.629	3.749
8 less 9	35	68.700	2.020	27	66.548	3.999
9 less 10	33	69.442	3.230	36	68.366	3.617
10 less 11	40	70.772	2.285	26	68.838	3.355
11 less 12	34	71.052	2.338	29	70.255	2.877

Figure 6 : Centiles for length according to age during the first year (males and females)



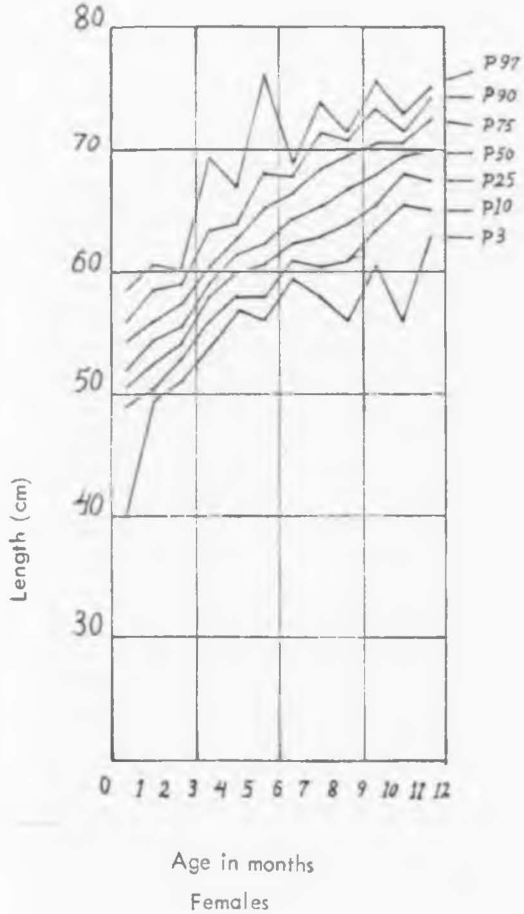
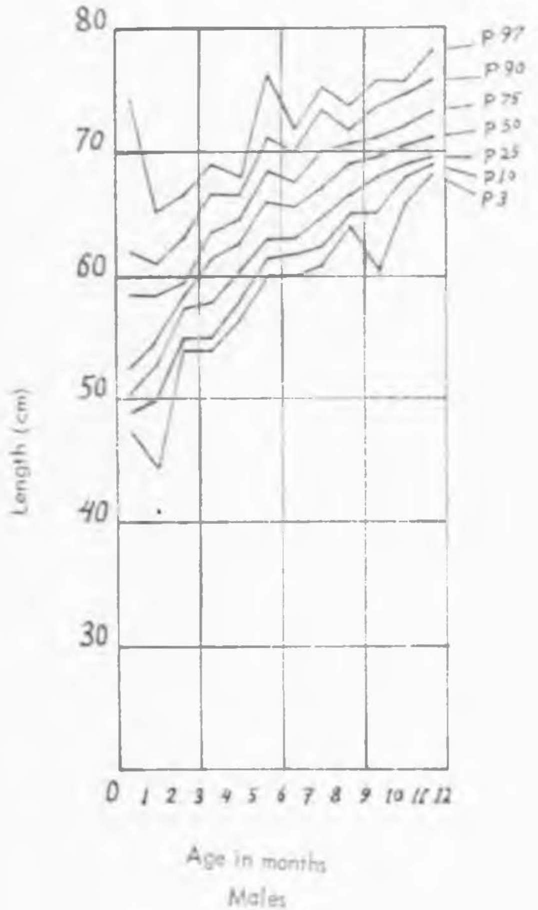


Figure 6 : Centiles for length according to age during the first year
(males and females)



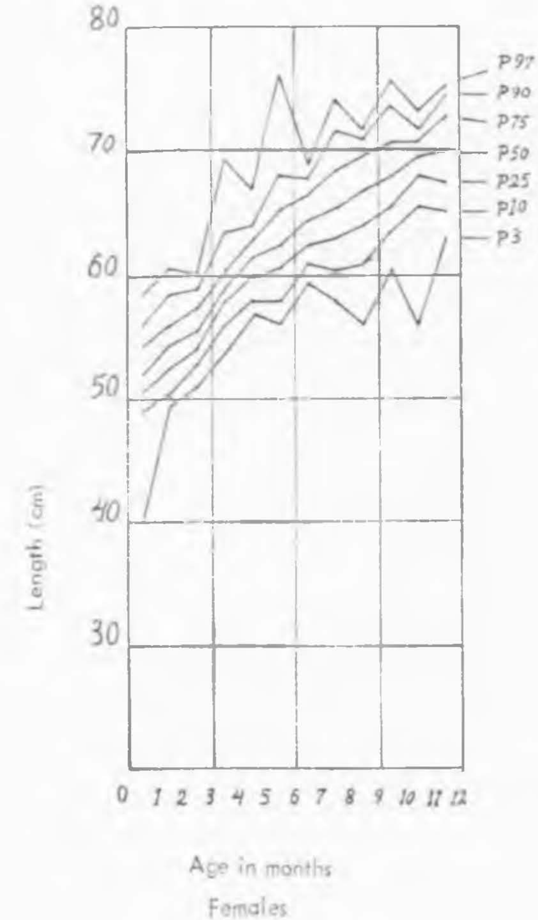


Table 43

MEAN WEIGHT/HEIGHT RATIO (Kg/Cm) BY AGE AND SEX

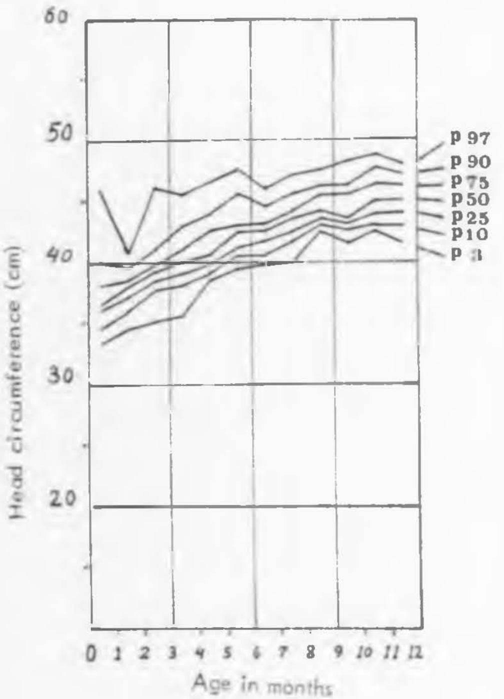
Age (months)	Males No.	Males Mean	Males S.D.	Females No.	Females Mean	Females S.D.
0 less 1	16	0.081	0.017	19	0.073	0.008
1 less 2	26	0.082	0.011	32	0.077	0.010
2 less 3	39	0.091	0.011	36	0.082	0.011
3 less 4	24	0.097	0.016	35	0.095	0.013
4 less 5	32	0.096	0.012	31	0.099	0.016
5 less 6	28	0.109	0.015	29	0.105	0.014
6 less 7	38	0.106	0.012	25	0.106	0.011
7 less 8	45	0.116	0.018	34	0.115	0.011
8 less 9	35	0.122	0.015	26	0.114	0.015
9 less 10	33	0.116	0.016	36	0.115	0.010
10 less 11	39	0.125	0.016	26	0.119	0.013
11 less 12	34	0.122	0.012	29	0.115	0.013

Table 44

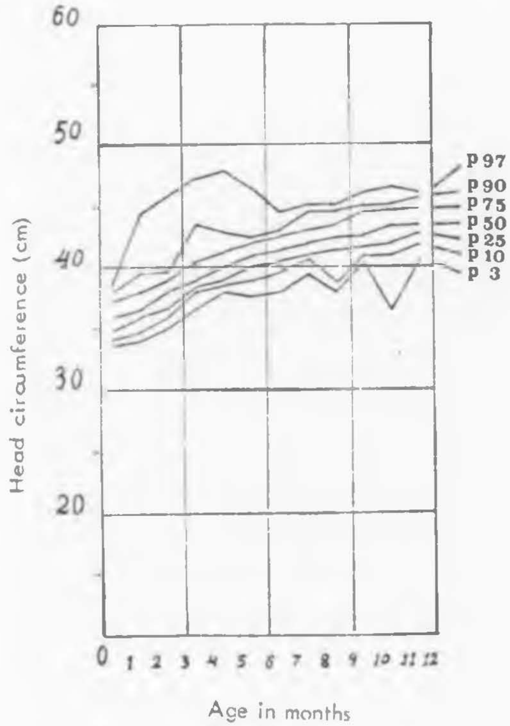
CHILDREN'S HEAD CIRCUMFERENCE (Cm) BY AGE AND SEX

	Males			Females		
Age (months)	No.	Mean	S.D.	No.	Mean	S.D.
0 less 1	16	37.343	2.739	19	36.126	1.269
1 less 2	26	37.765	1.432	32	37.224	2.065
2 less 3	39	39.366	2.138	36	38.049	1.736
3 less 4	24	40.129	2.313	35	39.911	2.634
4 less 5	32	41.587	2.736	31	40.722	2.288
5 less 6	28	42.574	1.804	29	40.989	1.744
6 less 7	40	42.754	1.385	25	41.500	1.372
7 less 8	47	43.470	1.565	35	42.228	1.479
8 less 9	35	44.397	1.459	27	42.340	1.997
9 less 10	33	44.121	1.694	36	42.988	1.542
10 less 11	40	45.174	1.718	26	43.092	1.943
11 less 12	34	44.841	1.581	29	43.506	1.314

Fig. 7 : Centiles for head circumference according to age during the first year (males and females)

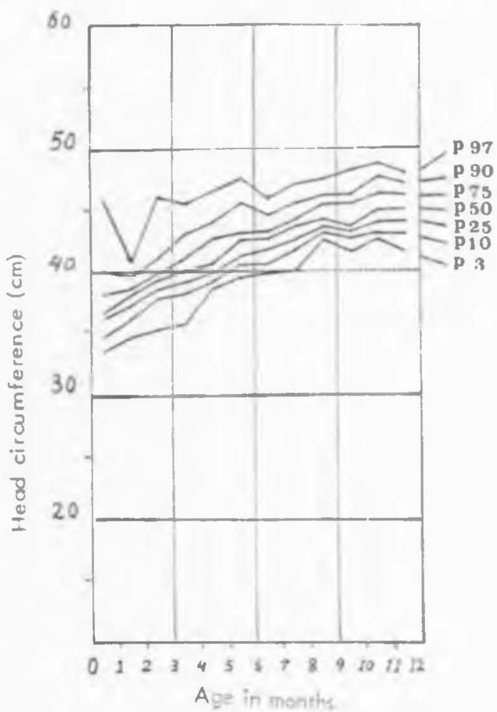


Males

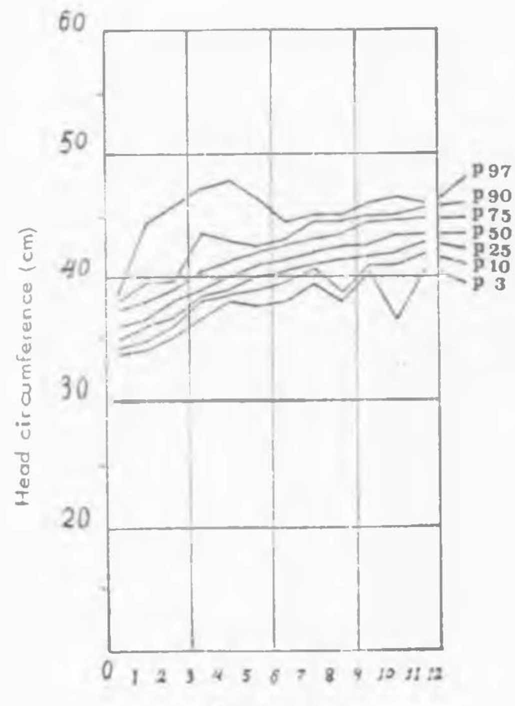


Females

Fig. 7 : Centiles for head circumference according to age during the first year (males and females)



Males



Females

Table 45

CHILDREN'S ARM CIRCUMFERENCE (Cm) BY AGE AND SEX

	Males			Females		
Age (months)	No.	Mean	S.D.	No.	Mean	S.D.
0 less 1	16	11.799	1.276	19	10.484	1.134
1 less 2	25	11.379	1.542	32	11.237	1.258
2 less 3	39	12.379	1.124	36	11.794	1.491
3 less 4	24	12.762	1.449	35	12.559	1.208
4 less 5	32	12.559	1.480	31	12.916	1.432
5 less 6	28	12.989	1.452	29	12.824	1.073
6 less 7	40	13.297	1.504	25	12.835	1.166
7 less 8	47	13.772	1.162	35	13.365	1.144
8 less 9	35	14.002	1.391	27	13.214	1.063
9 less 10	33	13.681	1.360	34	13.702	1.121
10 less 11	40	14.074	1.275	26	13.719	1.151
11 less 12	34	13.964	0.992	29	13.558	1.133

Table 46

MEAN TRICEPS SKINFOLD THICKNESS (Mm) BY AGE AND SEX

	Males			Females		
Age (months)	No.	Mean	S.D.	No.	Mean	S.D.
0 less 1	16	5.349	0.983	18	4.444	1.449
1 less 2	26	5.811	2.023	31	5.799	2.016
2 less 3	39	6.443	1.434	36	5.644	1.305
3 less 4	24	6.624	1.885	35	7.137	1.980
4 less 5	32	6.753	2.047	31	7.058	1.910
5 less 6	28	7.142	1.722	29	7.331	2.508
6 less 7	40	6.699	1.721	24	6.899	1.352
7 less 8	47	7.740	2.242	35	7.125	1.869
8 less 9	34	7.614	1.924	27	6.418	1.712
9 less 10	33	7.112	1.908	36	7.199	1.858
10 less 11	40	7.237	1.414	26	6.442	1.431
11 less 12	34	6.447	1.529	29	6.493	1.435

Table 47

MEAN BICEPS SKINFOLD THICKNESS (Mm) BY AGE AND SEX

	Males			Females		
Age (months)	No.	Mean	S.D.	No.	Mean	S.D.
0 less 1	16	3.862	0.627	18	3.377	0.848
1 less 2	26	4.415	1.231	31	4.019	1.188
2 less 3	39	4.466	0.844	36	3.994	1.075
3 less 4	24	4.137	0.912	35	4.897	1.241
4 less 5	32	4.343	1.195	31	4.103	0.995
5 less 6	28	4.364	1.107	29	4.358	1.108
6 less 7	40	4.349	1.141	25	4.271	0.960
7 less 8	47	4.789	1.405	35	4.222	1.053
8 less 9	34	4.708	1.517	27	4.385	1.570
9 less 10	33	3.933	0.751	36	4.505	1.121
10 less 11	40	4.254	0.912	26	4.488	1.554
11 less 12	34	3.897	0.557	29	4.268	1.133

Table 48

MEAN SUBSCAPULAR SKINFOLD THICKNESS (Mm) BY AGE AND SEX

	Males			Females		
Age (months)	No.	Mean	S.D.	No.	Mean	S.D.
0 less 1	16	5.062	1.315	18	4.266	1.031
1 less 2	26	5.557	1.784	31	7.012	2.811
2 less 3	39	7.058	2.049	36	6.888	2.607
3 less 4	24	6.554	2.283	35	7.651	2.665
4 less 5	32	7.174	3.096	31	8.012	2.701
5 less 6	28	7.217	2.325	29	7.662	3.153
6 less 7	40	6.729	2.483	25	6.383	1.893
7 less 8	47	7.346	2.293	35	6.959	2.168
8 less 9	33	6.939	2.263	27	6.440	1.710
9 less 10	33	6.578	2.548	36	6.869	2.500
10 less 11	40	6.532	2.027	26	6.407	2.211
11 less 12	34	6.252	2.075	29	6.220	2.061

Table 49

MEAN SUPRAILIAC SKINFOLD THICKNESS (Mm) BY AGE AND SEX

	Males			Females		
Age (months)	No.	Mean	S.D.	No.	Mean	S.D.
0 less 1	16	5.324	1.342	18	4.338	1.064
1 less 2	26	4.942	1.602	31	5.293	1.557
2 less 3	39	5.882	1.377	36	5.288	1.645
3 less 4	24	5.733	1.616	35	6.022	1.406
4 less 5	32	5.140	1.467	31	5.729	1.517
5 less 6	28	5.299	1.170	29	5.620	1.454
6 less 7	40	5.477	1.394	25	5.503	0.927
7 less 8	47	6.063	1.665	35	5.671	1.025
8 less 9	33	6.048	1.551	27	5.407	1.391
9 less 10	33	5.066	1.193	36	5.830	1.349
10 less 11	40	5.634	1.295	26	5.565	1.393
11 less 12	34	5.094	1.018	29	5.255	0.902

Table 50

COEFFICIENT OF VARIATION OF ANTHROPOMETRIC MEASUREMENTS
AVERAGE OF MONTHLY VALUES DURING THE FIRST YEAR

Measurement	Males	Females	Sexes combined
Weight	17.7	14.7	16.9
Height	5.2	5.0	5.5
Weight/Height	14.1	12.2	13.5
Head circumference	4.1	4.3	4.7
Arm circumference	10.2	9.4	10.0
Triceps	25.6	26.8	26.6
Biceps	23.3	24.9	25.8
Subscapular	33.3	33.5	33.9
Suprailiac	25.3	23.8	25.0

d. ANTHROPOMETRY OF 0-5 YEAR OLD CHILDREN

0-5 Years Weight Measurement: Table 51 shows that the greatest absolute and relative increases* in body weight for both sexes occured during the first year of life. However, in the following age, there was a gradual decrease in the absolute and a sharper decrease in the relative values as age increased.

During the second year, the absolute and relative values for the increase in weight continued to fall gradually. The total increase in the mean body weight during the second year was 2.2 Kg. During the third, fourth and fifth years the increments in the mean body weight were less.

On average the mean weight of both sexes combined, when taking the birth weight as it was in this study (birth measurements) as a reference (3285 gm); doubled at the age of 5-6 months, tripled at about the age of 18-20 months and became four-fold at about the age of 36-38 months.

Males in general were significantly heavier than females in almost all age groups, as shown in Table 52.

Tables 53, 54 and figures 9 and 10 show the children's weight centiles by age and sex.

The mean body weight of the Jordanian child at different age intervals is compared with equivalent values reported in the USA and Egypt (1972) as shown in Table 55 and figure 11. The body weight increments in the different age periods

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*Relative increase: the differnece as a percent of the mean weight in a given age interval.

in these countries are shown in Table 56. Figure 12 shows the increment in the mean body weight.

The mean body weight of the Jordanian children during the first three months of life was higher than the Egyptian mean weight. However, because the figures in this study are not longitudinal, they should be interpreted with caution.

Figures 13 and 14 show the 10th, 50th and 90th centiles of 1-24 month old male and female children in this study plotted against Tanner's standards; the growth pattern showed also a fall in the weight measurement especially after the age of 6-9 months.

Table 51

CHILDREN'S WEIGHT (Kg) BY AGE AND SEX

Age (months)	Males No.	Males Mean	Males S.D.	Females No.	Females Mean	Females S.D.
0 - 3	81	4.949	1.110	87	4.323	0.765
3 - 6	84	6.444	1.316	95	6.141	1.097
6 - 9	120	7.785	1.273	86	7.381	1.061
9 - 12	106	8.587	1.258	91	8.053	0.986
12 - 15	104	9.228	1.300	96	8.427	1.160
15 - 18	97	9.617	1.348	100	9.144	1.282
18 - 21	96	10.578	1.418	71	9.575	1.182
21 - 24	95	10.781	1.302	83	10.318	1.606
24 - 27	76	11.225	1.123	115	10.839	1.309
27 - 30	94	11.784	1.223	69	11.433	1.285
30 - 33	83	12.358	1.346	92	11.997	1.261
33 - 36	92	12.704	1.390	82	12.270	1.637
36 - 39	107	13.272	1.734	95	12.908	1.309
39 - 42	78	13.610	1.728	71	13.475	1.657
42 - 45	71	14.509	1.580	73	14.014	1.624
45 - 48	97	14.829	1.556	93	14.204	1.589
48 - 51	80	14.842	1.736	86	14.473	1.628
51 - 54	90	15.371	1.759	58	14.710	1.766
54 - 57	62	15.464	1.746	40	15.235	1.649
57 - 60	65	16.371	1.868	67	15.686	1.912
60 - 63	138	16.647	2.136	158	16.183	2.196

Figure: 8 CHILDRENS WEIGHT (Kg) ACCORDING TO AGE AND SEX

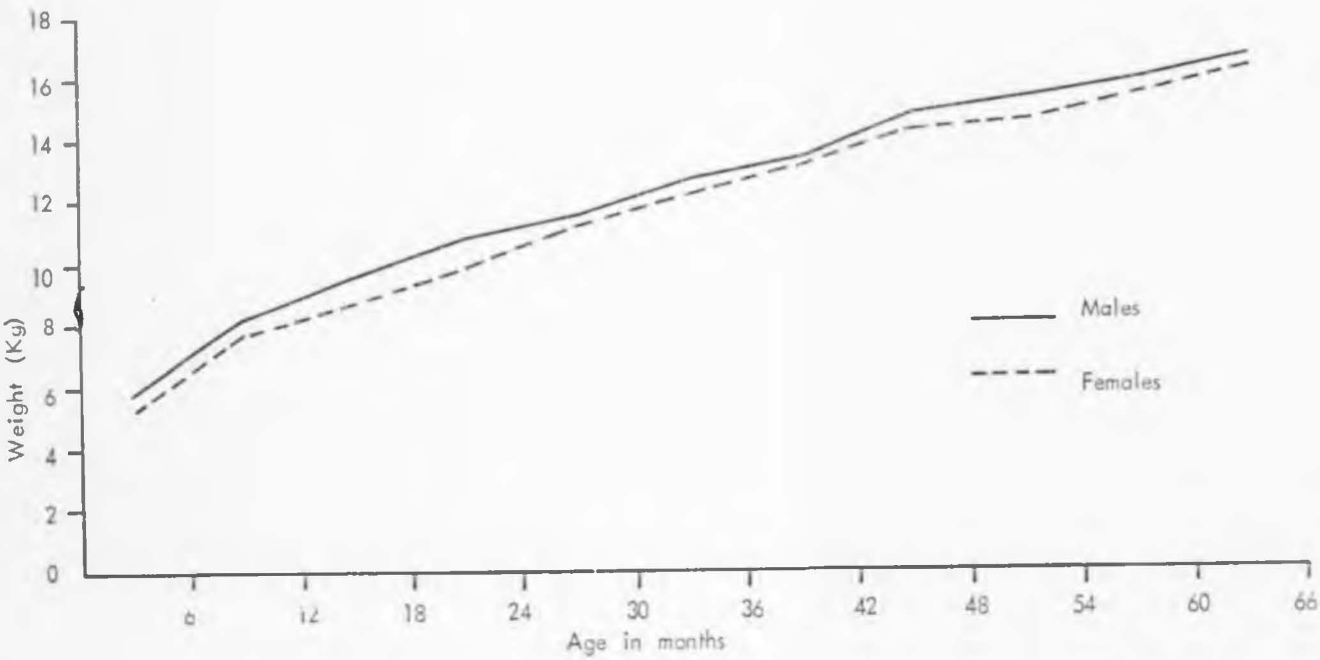


Figure: 8 CHILDRENS WEIGHT (Kg) ACCORDING TO AGE AND SEX

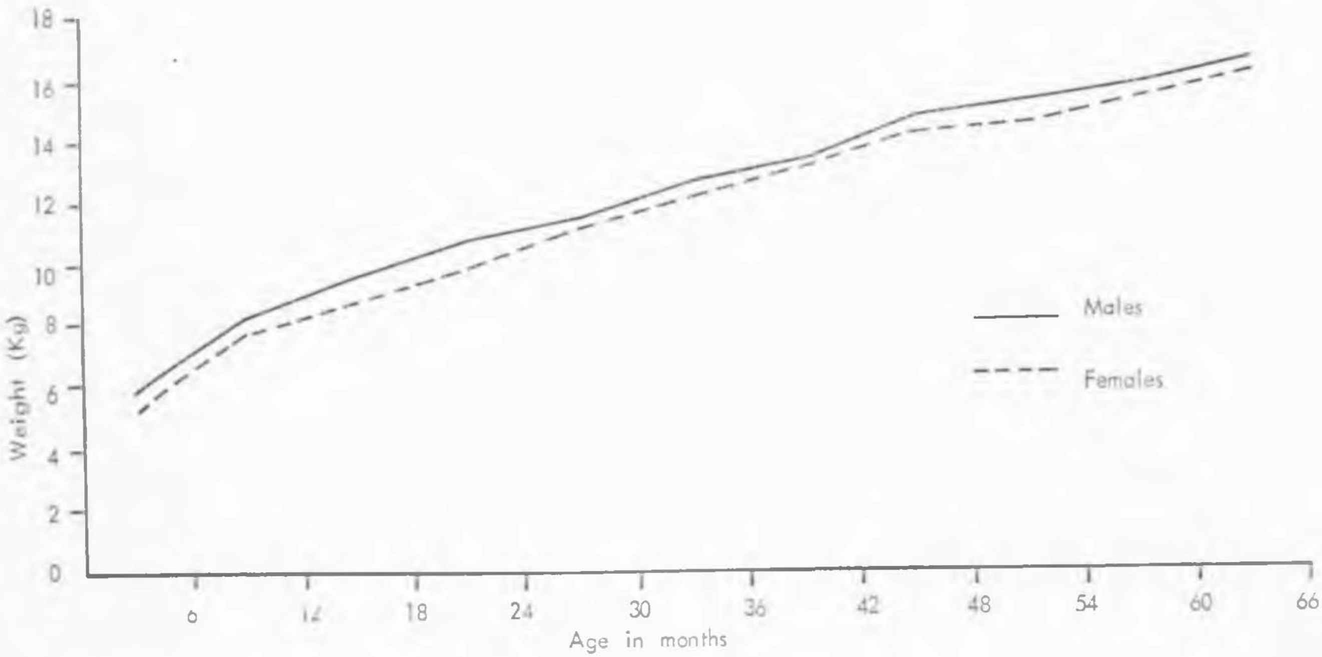


Table 52

SIGNIFICANCE TESTS BETWEEN MALES AND FEMALES FOR DIFFERENT MEASUREMENTS ACCORDING TO AGE GROUPS

	Weight	Height	Weight/ Height ratio	Head circumference	Arm circumference	Triceps	Biceps	Subscapular	Suprailiac
0 - 3	1%	1%	1%	1%	1%	NS	1%	5%	NS
3 - 6	NS	1%	NS	1%	NS	5%	NS	NS	5%
6 - 9	5%	1%	NS	1%	1%	5%	NS	NS	NS
9 - 12	1%	1%	5%	1%	NS	NS	1%	NS	NS
12 - 18	1%	1%	1%	1%	1%	1%	NS	1%	NS
18 - 24	1%	5%	1%	1%	1%	1%	NS	1%	1%
24 - 30	1%	NS	1%	1%	NS	5%	5%	1%	1%
30 - 36	1%	NS	5%	1%	NS	1%	5%	1%	5%
36 - 42	NS	NS	5%	1%	NS	1%	NS	1%	1%
42 - 48	1%	NS	1%	1%	NS	1%	5%	1%	1%
48 - 54	1%	NS	5%	1%	NS	1%	5%	1%	1%
54 - 60	NS	1%	NS	1%	NS	1%	5%	1%	1%
60+	NS	NS	1%	1%	NS	1%	5%	1%	1%

Table 53

CHILDREN'S WEIGHT (KG)   CENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					M A L E S			
0 - 3	81	3.198	3.651	4.194	4.884	5.597	6.328	7.288
3 - 6	84	4.131	4.706	5.517	6.338	7.263	8.249	9.393
6 - 9	120	5.226	6.172	6.894	7.747	8.779	9.602	10.138
9 - 12	106	5.967	6.841	7.820	8.651	9.370	10.181	10.907
12 - 15	104	6.549	7.543	8.387	9.291	10.167	10.821	11.539
15 - 18	97	6.291	7.745	8.711	9.701	10.671	11.352	11.703
18 - 21	96	8.382	9.121	9.617	10.428	11.472	12.419	13.377
21 - 24	95	8.393	9.190	9.973	10.963	11.638	12.426	13.383
24 - 27	76	9.266	9.691	10.384	11.203	11.928	12.645	13.519
27 - 30	94	9.351	10.218	10.939	11.766	12.563	13.400	14.180
30 - 33	63	9.635	10.563	11.375	12.381	13.309	14.054	14.604
33 - 36	92	10.119	10.743	11.626	12.673	13.771	14.349	15.195
36 - 39	107	10.224	11.092	12.034	13.121	14.248	15.741	17.044
39 - 42	78	11.021	11.422	12.211	13.495	14.815	15.854	17.392
42 - 45	71	11.266	12.261	13.303	14.680	15.704	16.197	17.484
45 - 48	97	12.011	12.874	13.636	14.797	15.836	16.934	17.833
48 - 51	80	12.055	12.818	13.631	14.735	15.676	17.087	17.908
51 - 54	90	12.184	13.392	14.458	15.220	16.323	17.389	19.147
54 - 57	62	11.320	13.394	14.395	15.483	16.723	17.613	18.483
57 - 60	65	13.559	14.227	15.383	16.178	17.678	18.600	19.807
60 - 63	138	13.065	14.544	15.303	16.431	18.050	19.477	21.000

Table 54

CHILDREN'S WEIGHT (KG) CENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					F E M A L E S			
0 - 3	87	3.078	3.256	3.639	4.264	4.932	5.453	5.956
3 - 6	95	4.118	4.810	5.274	5.976	6.779	7.594	8.807
6 - 9	66	5.314	6.092	6.709	7.250	8.021	8.795	9.591
9 - 12	91	5.983	6.758	7.390	7.983	8.694	9.252	9.875
12 - 15	96	6.499	6.812	7.443	8.417	9.250	9.883	10.597
15 - 18	100	5.684	7.492	8.470	9.236	9.865	10.512	10.941
18 - 21	71	7.039	7.921	8.708	9.560	10.435	11.244	11.791
21 - 24	83	7.255	8.509	9.324	9.913	10.883	12.522	14.052
24 - 27	115	8.316	8.906	10.085	10.608	11.813	12.572	13.383
27 - 30	69	8.772	10.092	10.661	11.380	12.367	13.204	13.558
30 - 33	92	9.690	10.369	11.097	11.907	12.737	13.496	14.843
33 - 36	82	9.309	10.326	11.207	12.242	13.244	14.295	15.579
36 - 39	95	10.295	10.880	12.060	12.901	13.641	14.634	15.671
39 - 42	71	10.092	11.298	12.371	13.425	14.750	15.487	17.009
42 - 45	73	10.697	11.969	12.990	14.097	15.190	15.961	17.458
45 - 48	93	10.849	12.656	13.045	14.195	15.191	16.294	17.156
48 - 51	86	11.278	12.602	13.293	14.483	15.424	16.382	17.493
51 - 54	58	11.973	12.747	13.443	14.523	15.987	17.263	17.658
54 - 57	40	12.753	13.566	14.325	15.008	15.875	17.981	19.587
57 - 60	67	12.253	13.083	14.553	15.627	17.109	18.197	19.297
60 - 63	158	12.150	13.433	14.821	16.140	17.594	18.667	19.992

Figure 9 : Childrens' weight centiles, males, 0-60 months

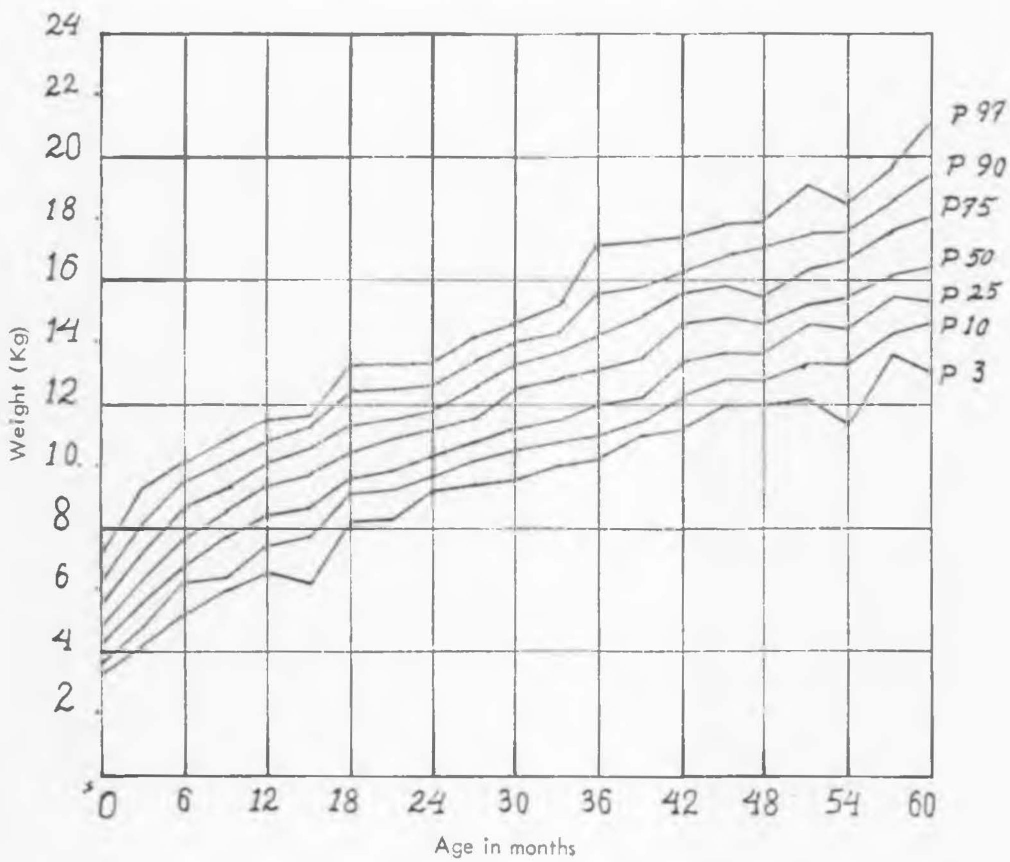


Figure 9 : Childrens' weight centiles, males, 0-60 months

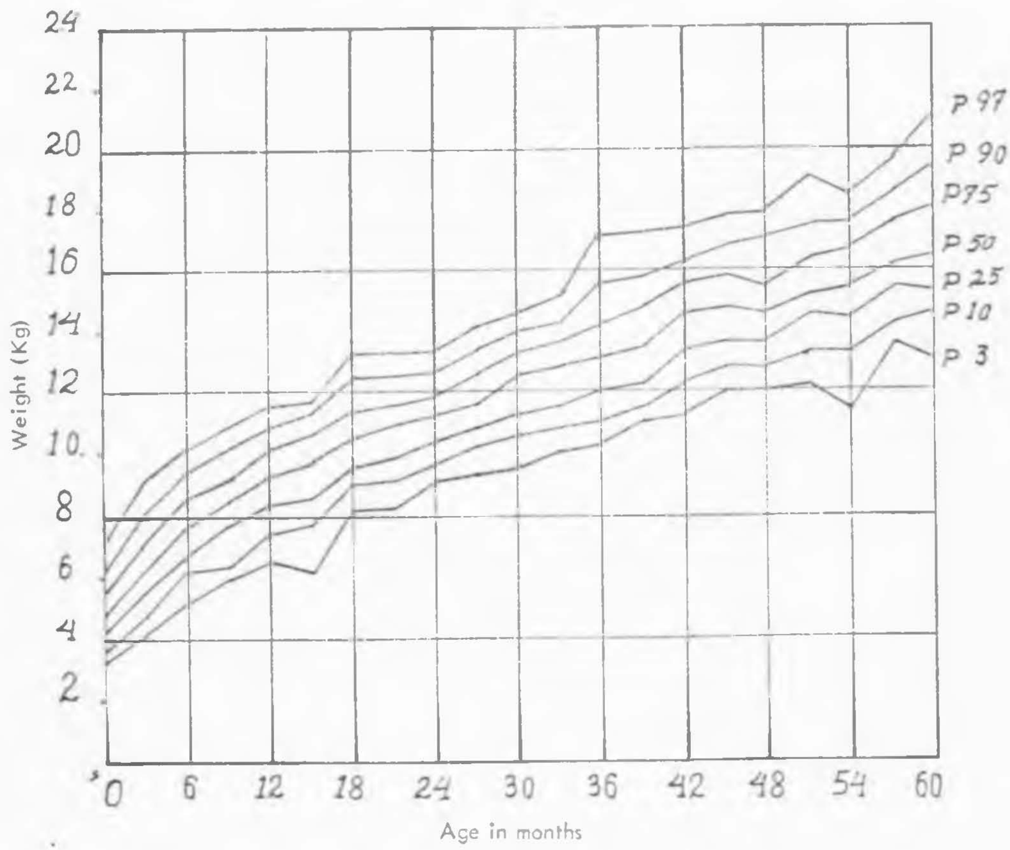


Figure 10: Childrens' weight centiles, females, 0-60 months

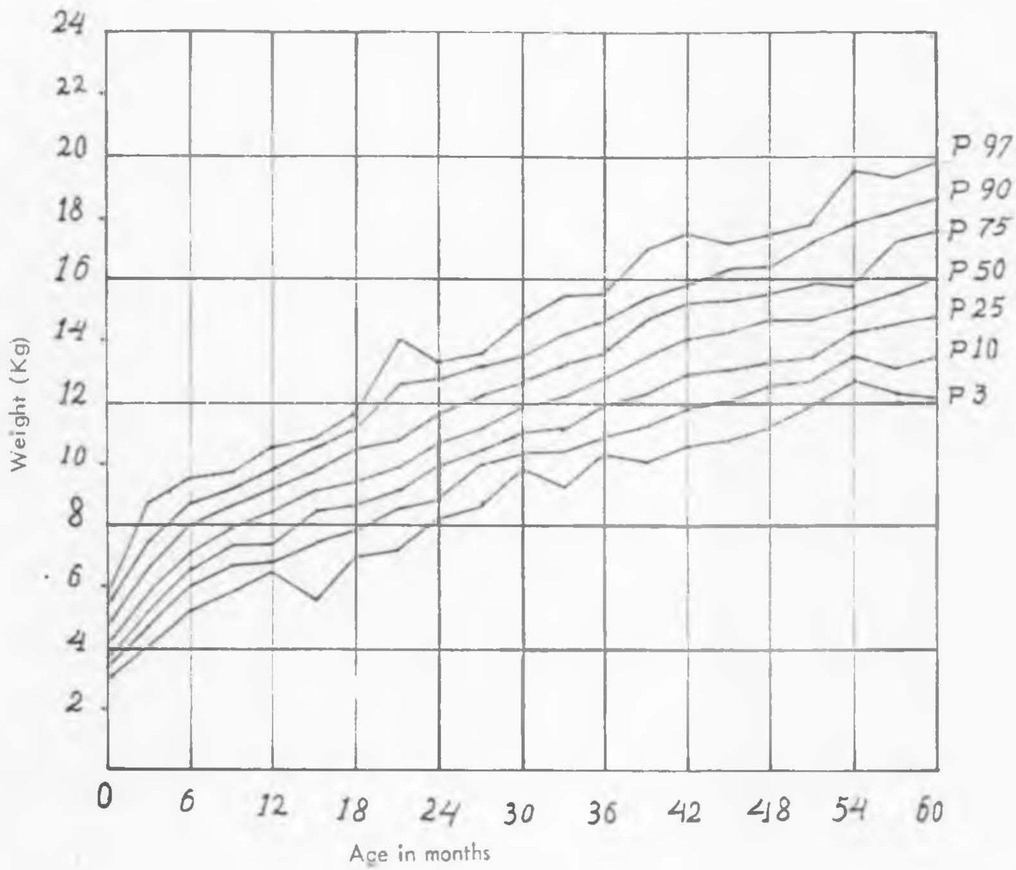


Figure 10c Childrens' weight centiles, females, 0-60 months

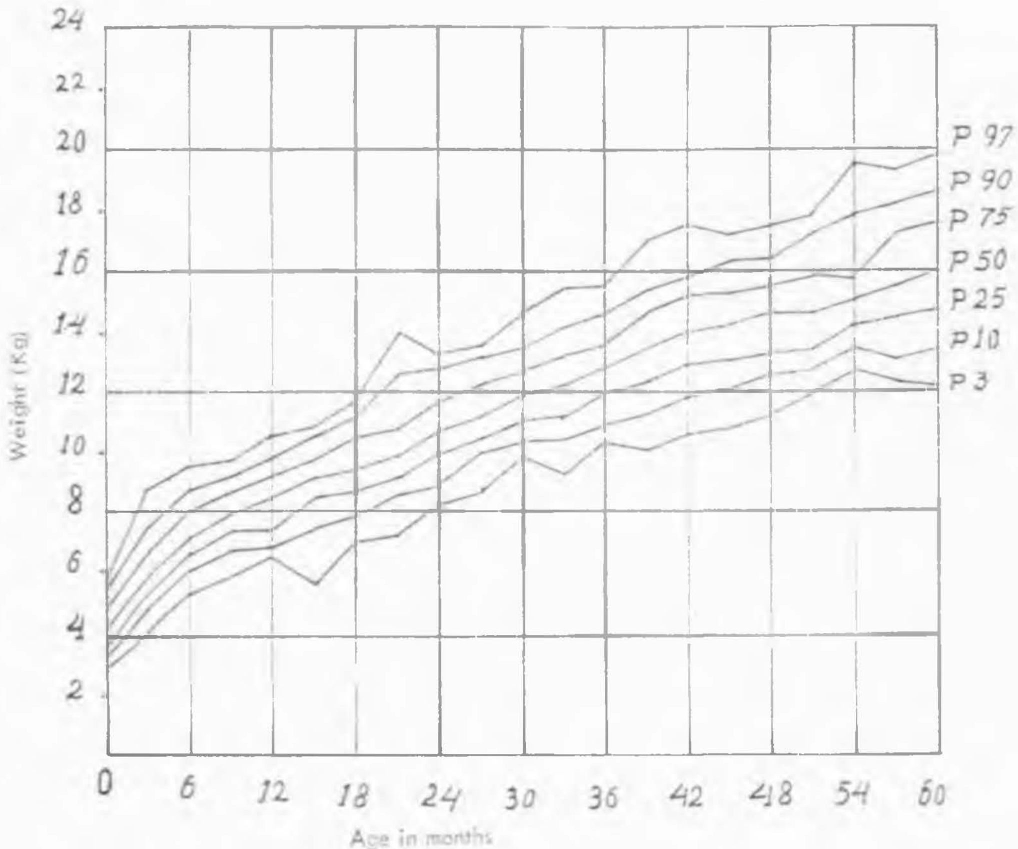


Table 55

MEAN BODY WEIGHT DURING THE PERIOD 0-60 MONTHS IN JORDAN AND OTHER COUNTRIES

	Jordan*		Egypt**		USA***	
Age (months)	M	F	M	F	M	F
0 - 3	4.94	4.32	3.80	3.65	-	-
3 - 6	6.44	6.14	5.71	5.27	5.72	5.62
6 - 9	7.78	7.38	7.33	6.70	7.58	7.26
9 - 12	8.58	8.05	8.11	7.58	9.07	8.71
12 - 18	9.41	8.78	8.81	8.16	10.07	9.75
18 - 24	10.67	9.94	10.02	9.56	11.43	11.11
24 - 36	12.02	11.63	11.02	10.71	12.56	12.29
36 - 48	13.30	13.64	13.79	13.35	14.61	14.42
48 - 60	15.50	15.02	15.58	15.29	16.51	16.42
60 - 63	16.64	16.18	17.75	17.05	18.37	18.37

*This study (1974)

** Abbassy et al. (1972)

*** Nelson (1965)

Figure 11 : Mean body weight, 0 - 60 months, males in Jordan and other countries

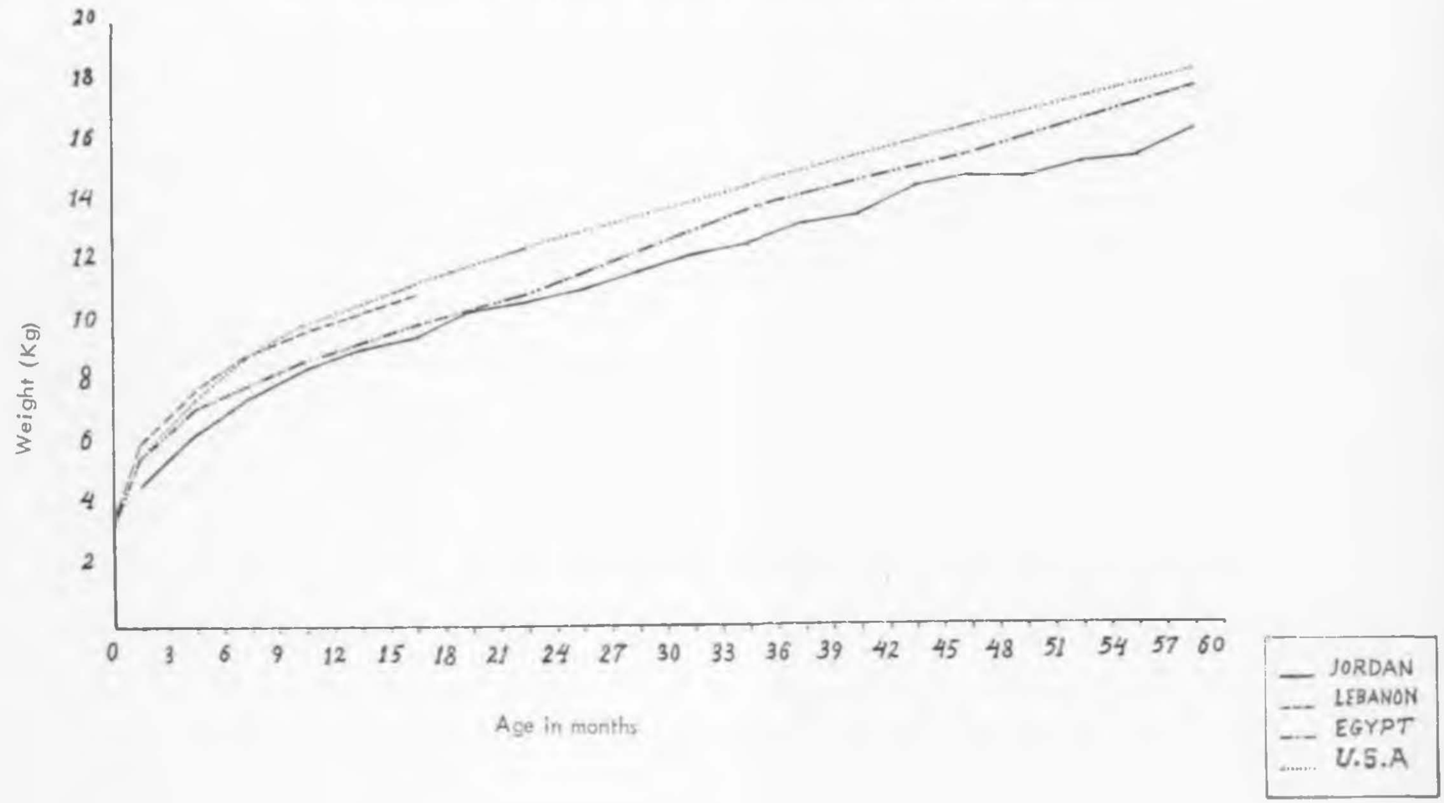


Figure 11 : Mean body weight, 0 - 60 months, males in Jordan and other countries

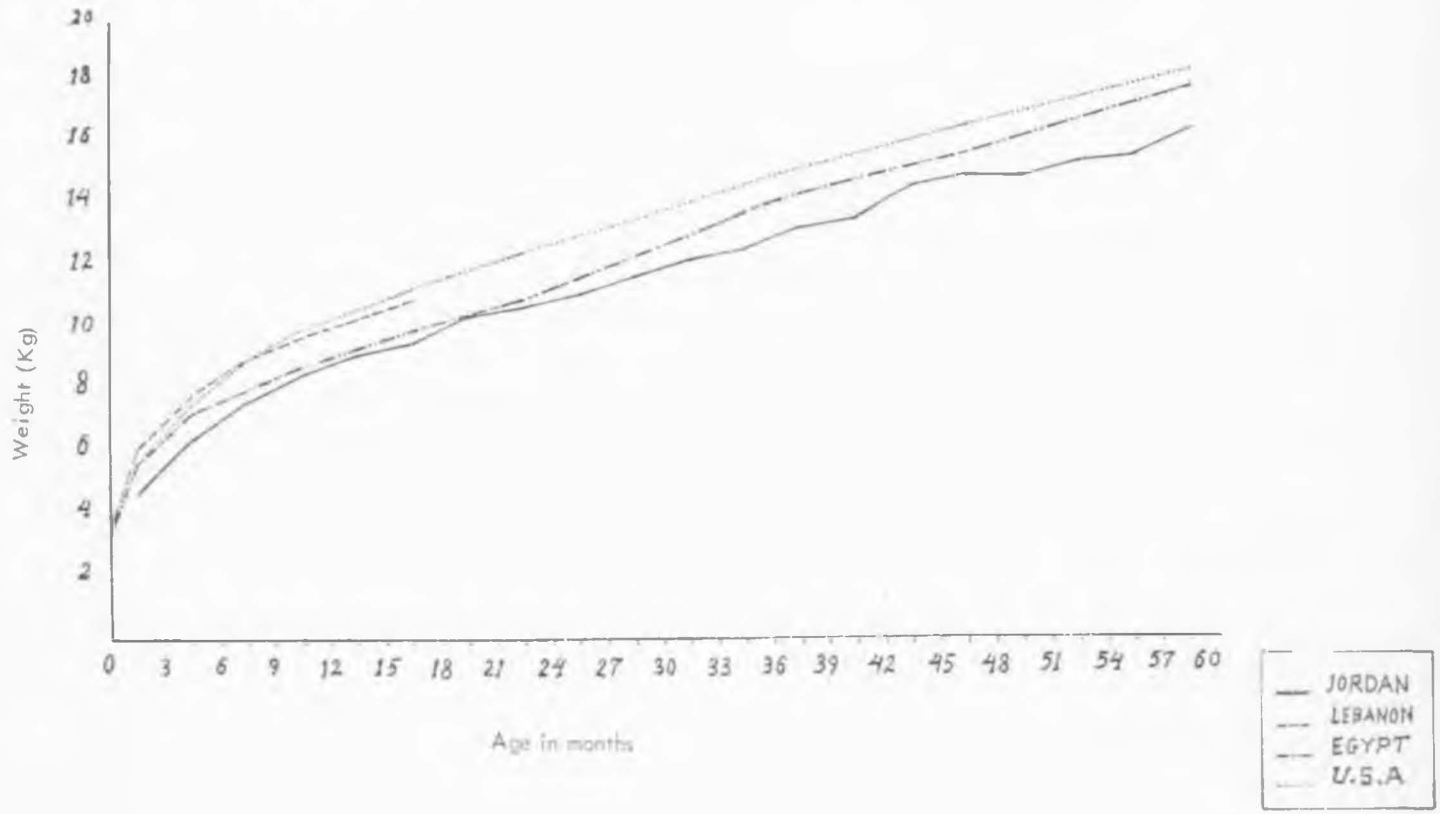


Table 56

INCREMENTS IN THE MEAN BODY WEIGHT DURING THE AGE PERIOD 0-60 MONTHS IN DIFFERENT COUNTRIES

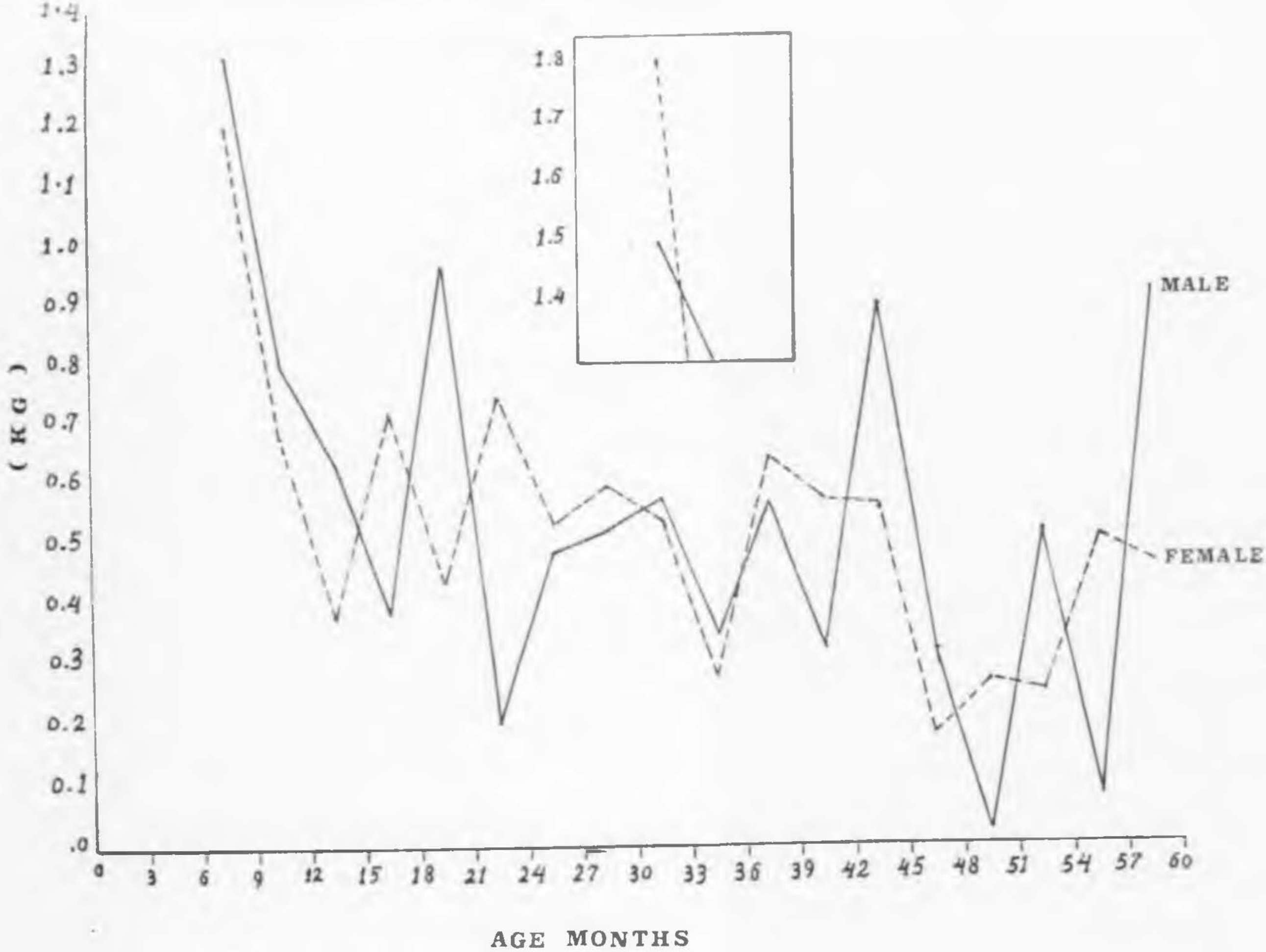
	Egypt*		Jordan**		USA***	
Age (months)	M	F	M	F	M	F
0 - 3	2.29	1.93	-	-	2.32	2.26
3 - 6	1.62	1.43	1.49	1.81	1.86	1.64
6 - 9	0.78	0.88	1.34	1.24	1.49	1.45
9 - 12	0.70	0.85	0.80	0.67	1.00	1.04
12 - 18	1.21	1.40	1.02	1.08	1.36	1.36
18 - 24	1.00	1.15	1.16	1.17	1.13	1.18
24 - 36	2.57	2.64	1.90	1.84	2.05	2.13
36 - 48	1.79	1.94	2.09	1.90	1.90	2.00
48 - 60	2.17	1.76	1.52	1.46	1.86	1.95

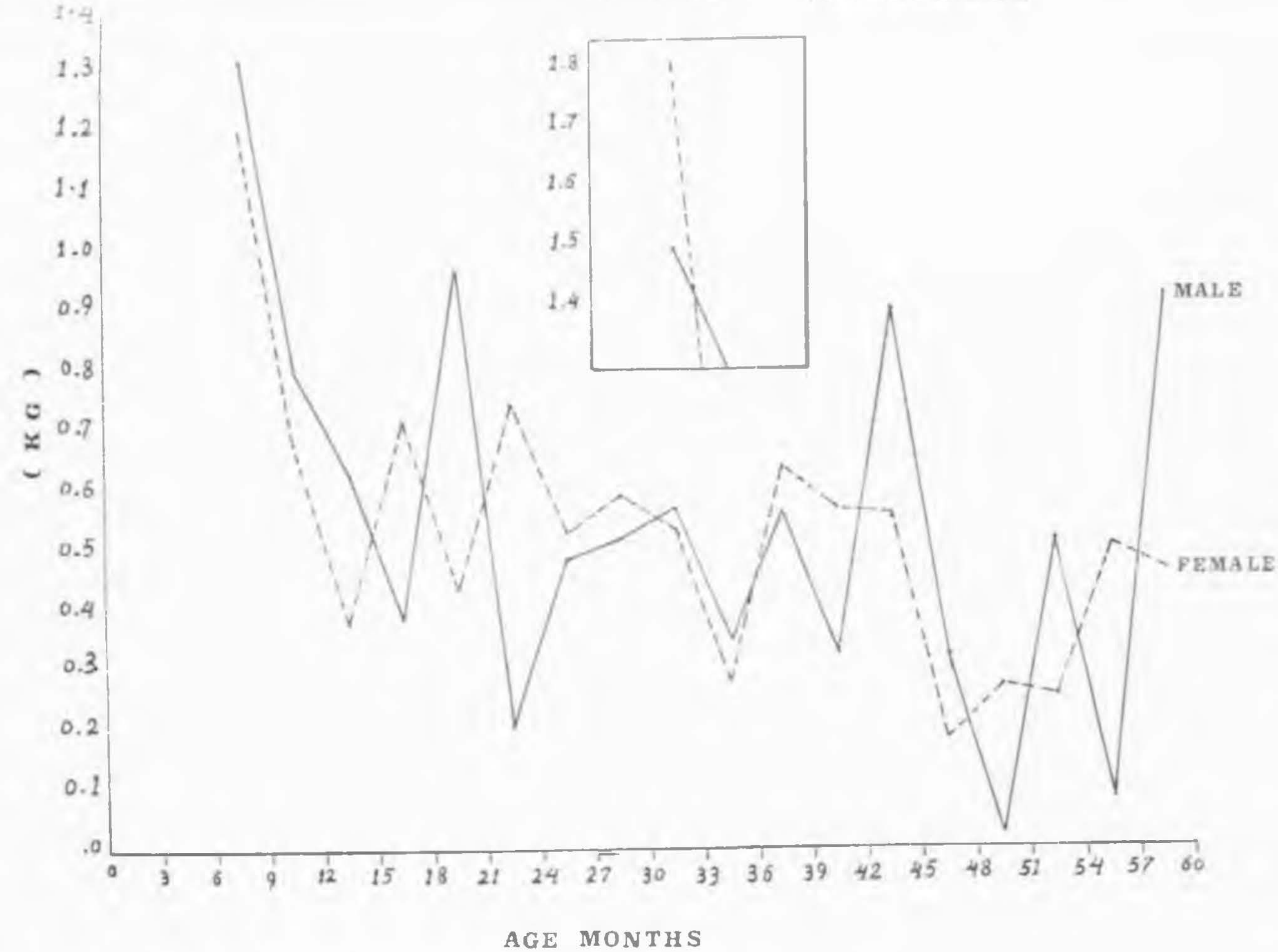
* Abbassy et al. (1972)

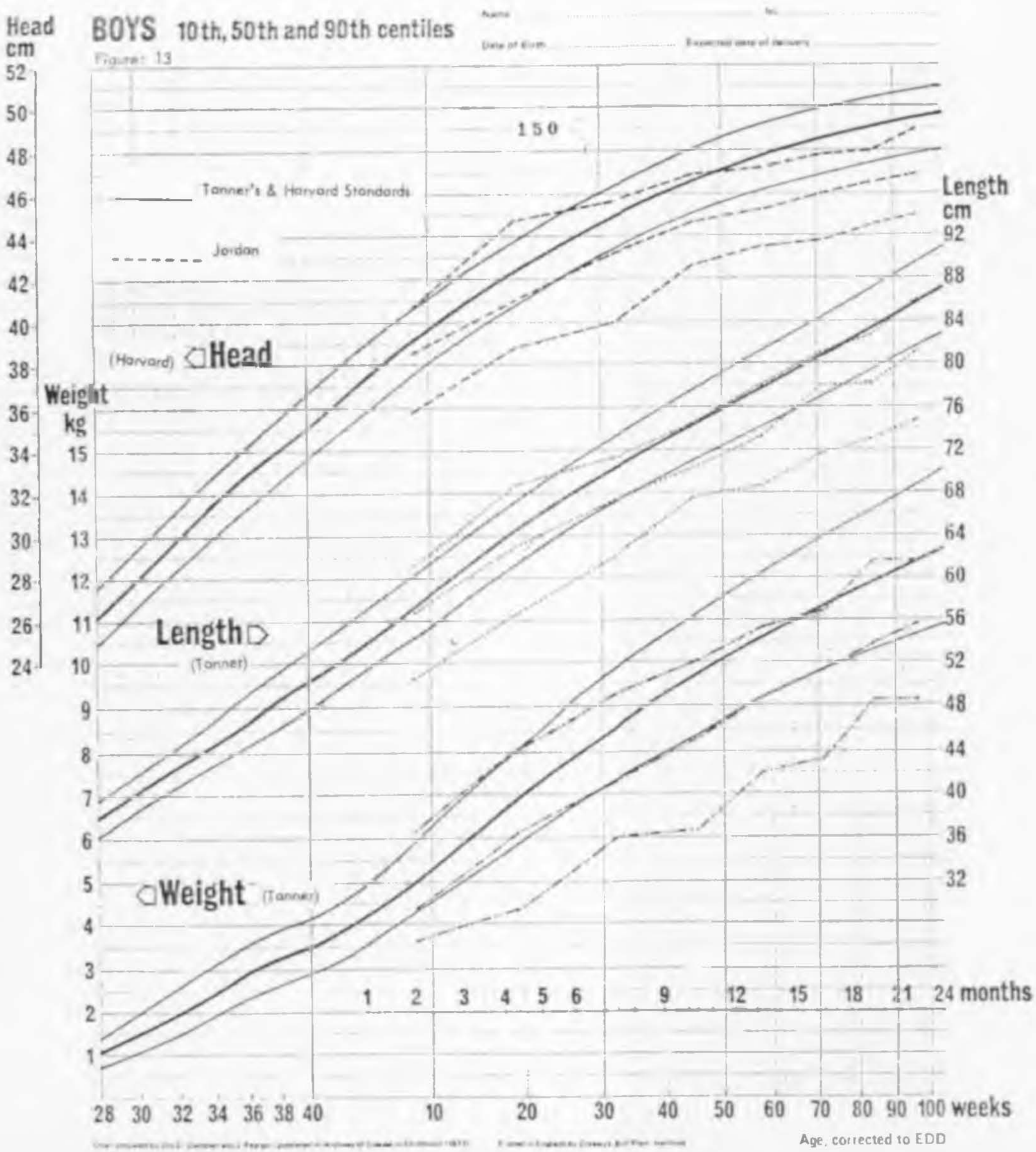
** This study (1974)

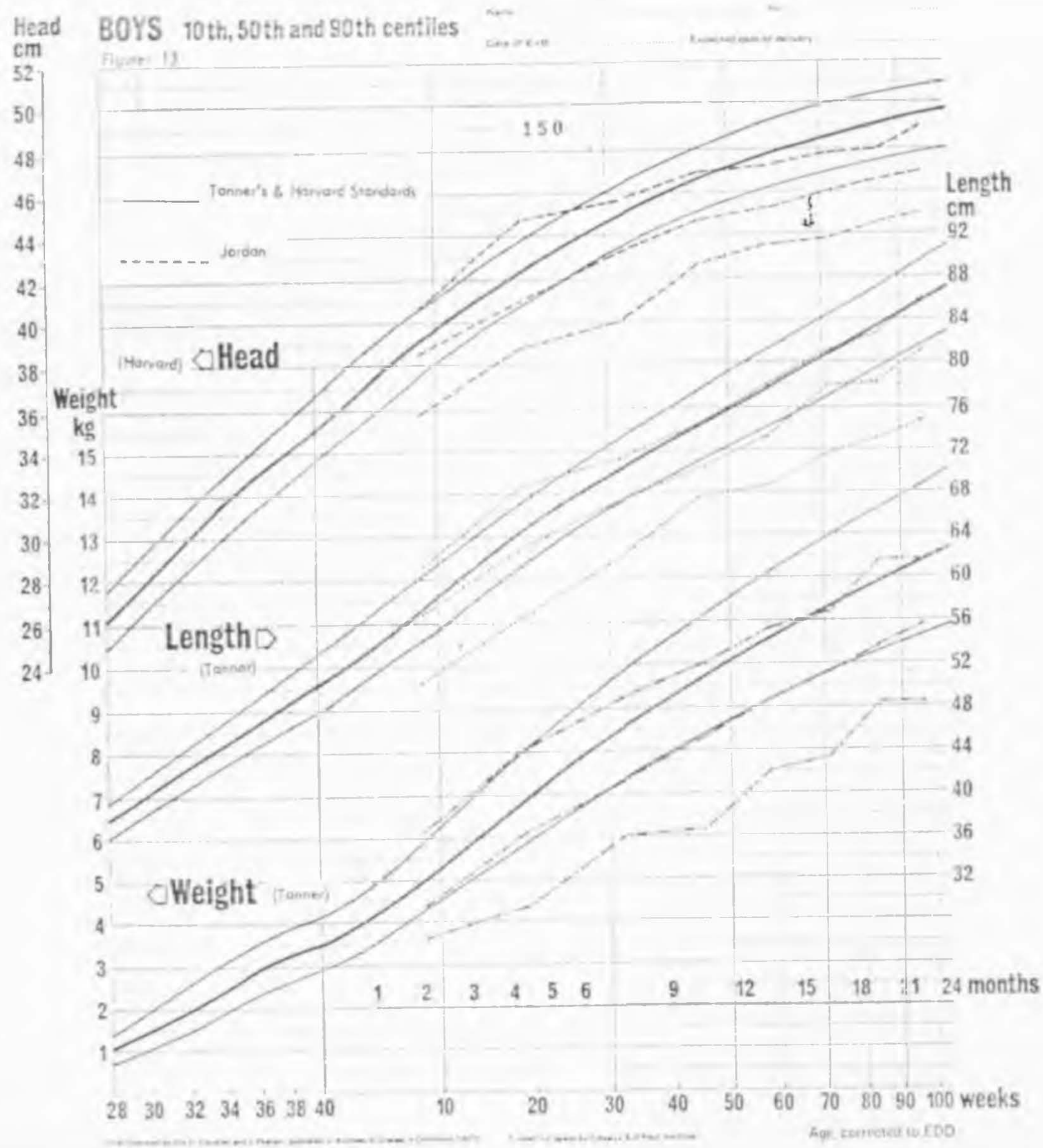
*** Nelson (1965)

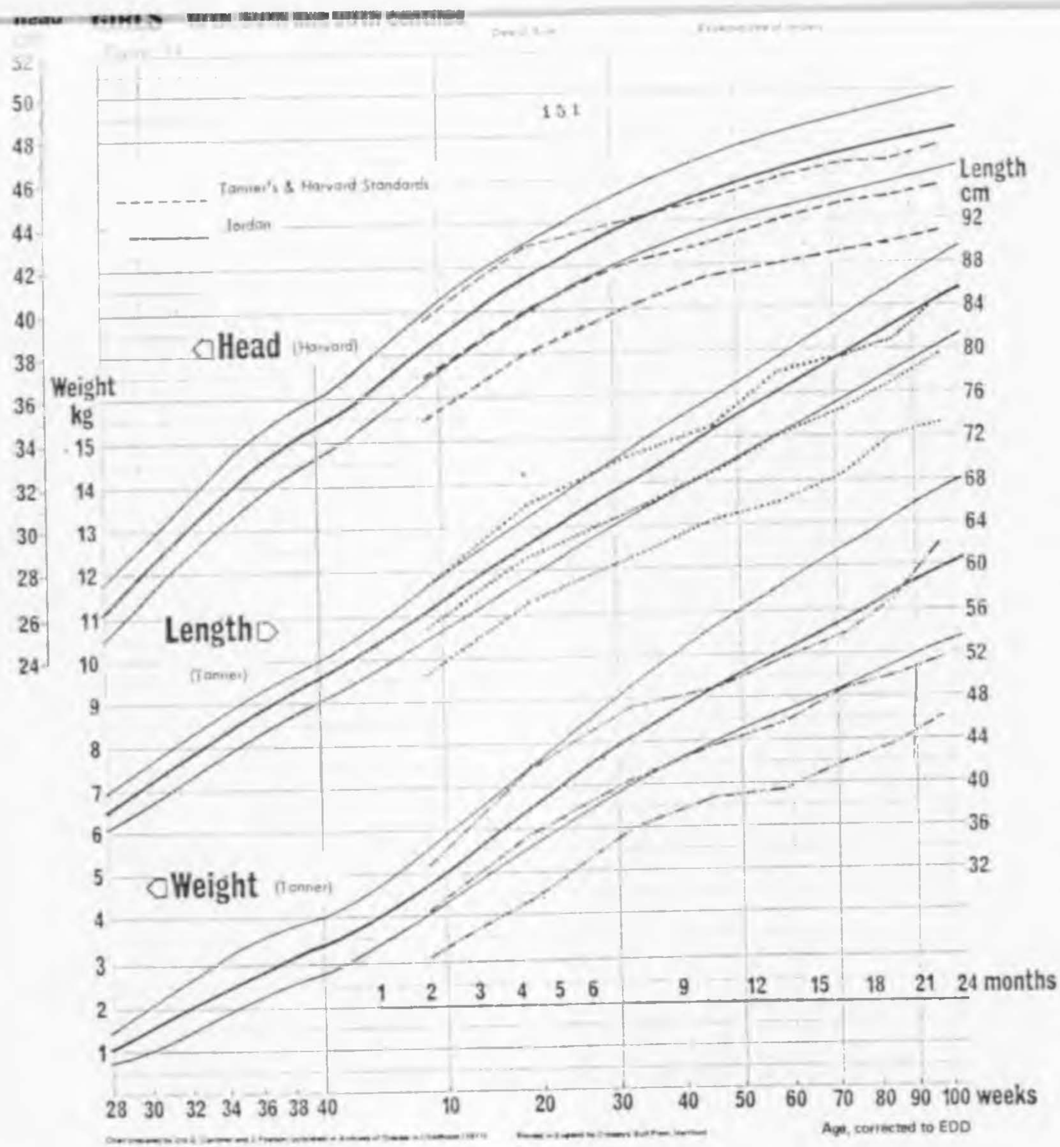
[illegible] mean weight, 0 – 60 months, of males and females



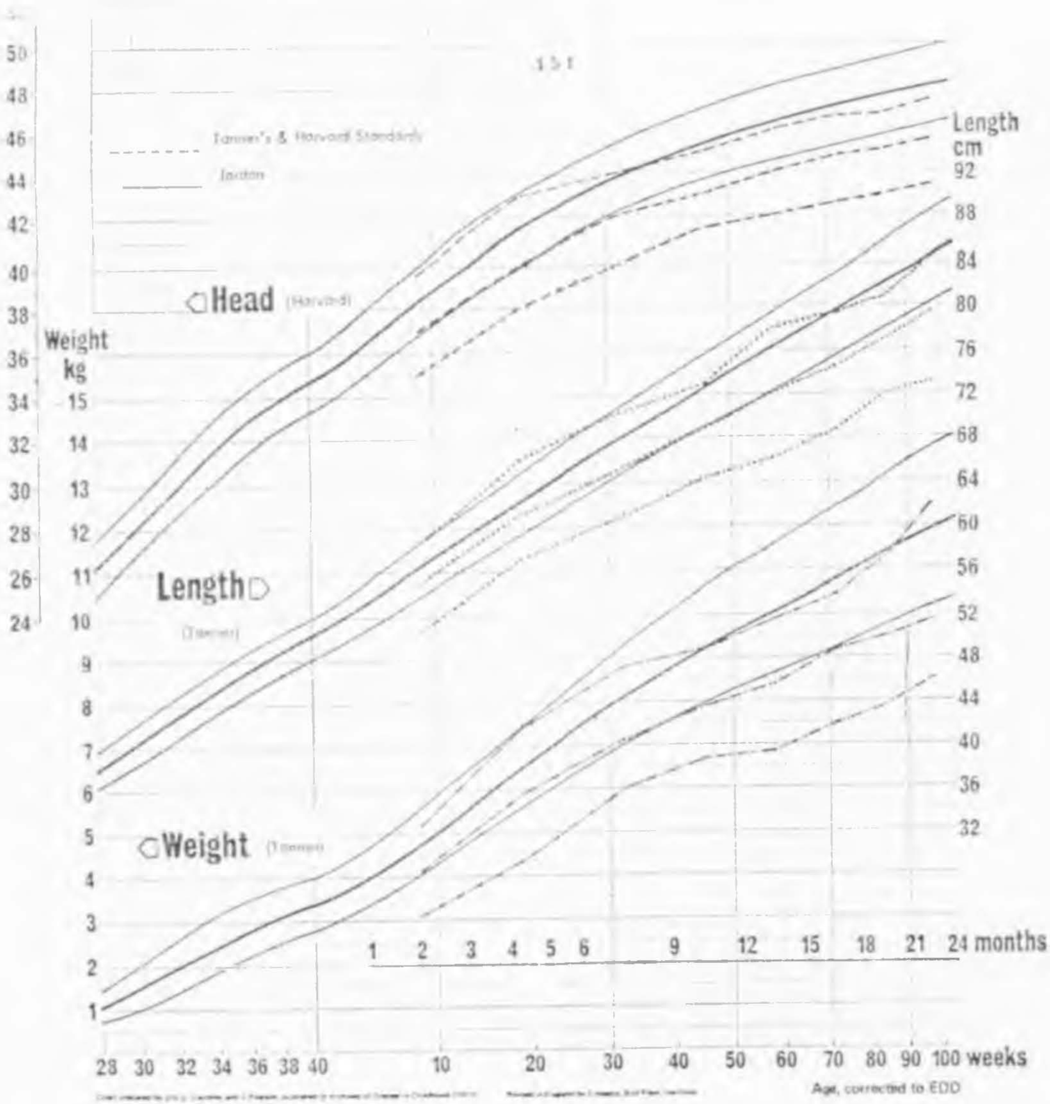

(KG)
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
.0
0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60
AGE MONTHS
MALE
FEMALE
1.8
1.7
1.6
1.5
1.4


BOYS 10th, 50th and 90th centiles
Figure: 13
Head cm
Weight kg
Length cm
150
Tanner's & Harvard Standards
Jordan
(Harvard) Head
Length (Tanner)
Weight (Tanner)
1 2 3 4 5 6 9 12 15 18 21 24 months
28 30 32 34 36 38 40 10 20 30 40 50 60 70 80 90 100 weeks
Age, corrected to EDD


Head cm
BOYS 10th, 50th and 90th centiles
Figure 13
Tanner's & Harvard Standards
Jordan
(Harvard) Head
Weight kg
Length (Tanner)
Weight (Tanner)
Length cm
1 2 3 4 5 6 9 12 15 18 21 24 months
28 30 32 34 36 38 40 10 20 30 40 50 60 70 80 90 100 weeks
Age, corrected to EDD



151
Tanner's & Harvard Standards
Jordan
Head (Harvard)
Length (Tanner)
Weight (Tanner)
Weight kg
Length cm
1 2 3 4 5 6 9 12 15 18 21 24 months
28 30 32 34 36 38 40 10 20 30 40 50 60 70 80 90 100 weeks
Age, corrected to EDD



Tanner's & Harvard Standards
Jordan
Head (Harvard)
Weight kg
Length (Tanner)
Weight (Tanner)
Length cm
1 2 3 4 5 6 9 12 15 18 21 24 months
28 30 32 34 36 38 40 10 20 30 40 50 60 70 80 90 100 weeks
Age, corrected to EDD

<u>0-5 Year Height Measurement:</u> Table 57 shows the mean values of height for males and females (figure 15).

Tables 58, 59 and figures 16 and 17 show the centiles for height during the first 60 months of life.

The first year of life witnessed the greatest relative increase in length. The increase occurred at a lower rate during the following four years.

Ma'es during the first two years of life were significantly taller than females, however, in the following age periods the difference was not significant.

Table 60 and figure 18 show the mean body length (cm) during the period 0-60 months in Jordan and in two other countries, Egypt and the USA.

Table 61 shows the increments in the mean body length of Jordanians in this study, Egyptians, American and Lebanese children. The Jordanian children showed similar length increments to those of the Americans shortly after birth. However, from the age of six to nine months onward, the Jordanian child fell behind both the American and Egyptian children.

Figures 13 and 14 show the 10th, 50th and 90th centiles of 1-24 month old male and female children in this study plotted against Tanner's standards; the stunting of the Jordanian children is clear from this figure especially after the age of six to nine months.

Table 57

CHILDREN'S HEIGHT (Cm) BY AGE AND SEX

Age (months)	Males No.	Males Mean	Males S.D.	Females No.	Females Mean	Females S.D.
0 - 3	81	56.682	4.530	87	54.805	3.190
3 - 6	84	63.320	4.208	95	61.382	3.526
6 - 9	120	67.419	3.800	86	65.583	3.555
9 - 12	107	70.451	2.692	91	69.103	3.385
12 - 15	102	73.555	3.663	95	72.308	4.430
15 - 18	96	76.562	3.454	101	74.443	3.949
18 - 21	96	78.287	6.500	71	76.614	5.912
21 - 24	93	80.683	4.072	81	79.485	4.539
24 - 27	76	81.943	4.154	114	80.983	4.508
27 - 30	93	83.462	7.198	69	83.392	4.377
30 - 33	84	85.782	6.467	91	85.708	4.810
33 - 36	93	87.803	6.516	82	86.374	6.023
36 - 39	106	89.254	5.060	95	89.094	5.120
39 - 42	78	91.225	4.397	71	91.781	5.415
42 - 45	71	94.201	4.532	73	93.672	6.455
45 - 48	97	96.347	4.334	93	94.926	4.582
48 - 51	80	96.512	5.094	86	95.491	4.192
51 - 54	90	97.882	5.226	58	97.444	5.547
54 - 57	61	100.665	4.083	40	99.102	4.379
57 - 60	65	102.824	4.124	67	100.395	6.802
60 - 63	138	102.597	9.377	158	102.987	6.789

Figure 15 : Mean height for males and females from birth to five years

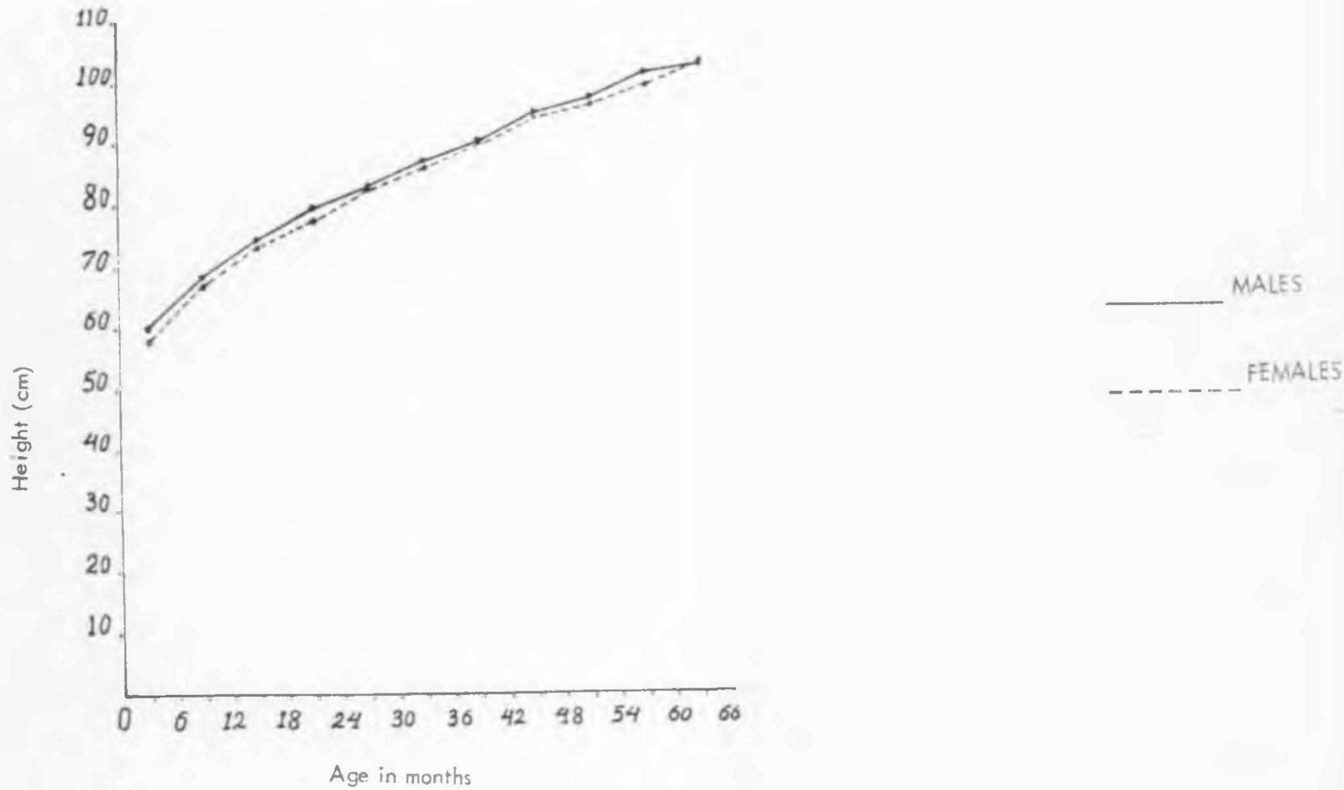


Figure 15 : Mean height for males and females from birth to five years

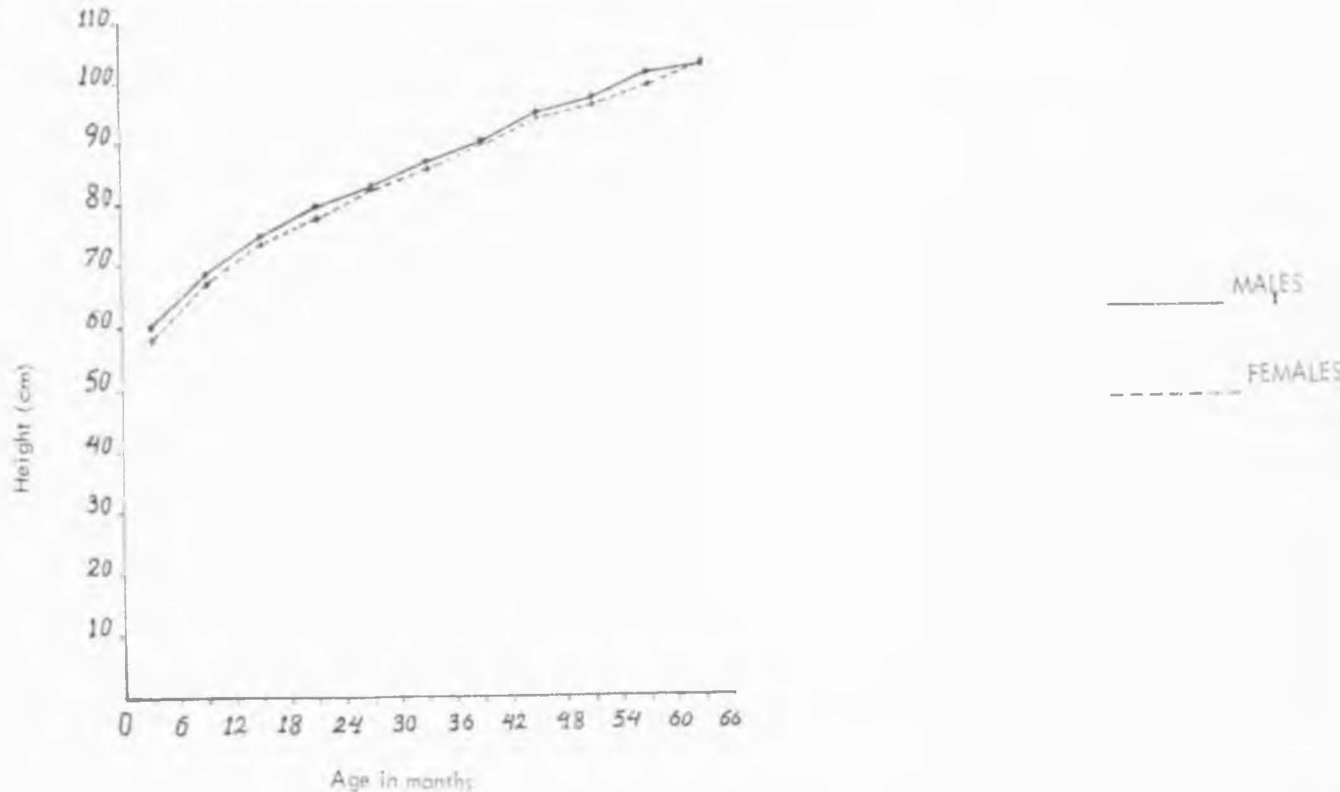


Table 58

CHILDREN'S HEIGHT (CM) PERCENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					M A L E S			
0 - 3	81	49.140	50.797	53.806	57.202	59.401	62.268	66.688
3 - 6	84	54.753	57.608	60.751	63.169	66.190	68.783	71.576
6 - 9	120	60.879	62.399	64.837	67.212	69.858	71.526	74.388
9 - 12	107	64.732	67.894	68.882	70.377	72.014	74.666	76.998
12 - 15	102	65.536	68.561	71.204	73.704	76.118	78.354	79.398
15 - 18	96	68.504	71.917	74.523	77.028	78.928	81.406	83.002
18 - 21	96	69.766	72.992	75.822	78.428	81.187	82.897	87.645
21 - 24	93	72.154	74.903	77.825	80.935	83.510	85.920	87.329
24 - 27	76	70.951	76.666	79.643	81.899	84.729	86.893	90.623
27 - 30	93	65.796	78.905	81.421	84.297	86.505	89.375	92.395
30 - 33	84	67.182	80.246	83.730	86.482	89.491	92.060	94.092
33 - 36	93	77.195	83.263	85.787	88.533	90.688	93.350	95.587
36 - 39	106	77.158	83.364	87.154	89.804	92.896	95.375	97.723
39 - 42	78	83.348	85.423	88.062	90.809	94.337	97.196	99.748
42 - 45	71	85.270	88.088	91.225	93.923	97.126	100.276	103.947
45 - 48	97	88.824	91.640	93.766	96.407	99.027	101.431	104.232
48 - 51	80	88.102	91.449	94.781	96.548	98.316	101.630	105.667
51 - 54	90	87.949	91.826	94.946	97.999	101.151	104.115	107.329
54 - 57	61	91.990	94.663	98.443	100.672	103.339	105.513	108.811
57 - 60	65	95.685	98.155	99.813	102.309	105.559	108.390	113.789
60 - 63	138	83.921	96.063	100.075	103.618	107.024	109.905	114.752

Table 59

CHILDREN'S HEIGHT (CM) PERCENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					F E M A L E S			
0 - 3	87	49.315	50.472	52.864	54.623	56.381	58.784	60.070
3 - 6	95	55.003	57.094	58.641	61.099	63.300	66.121	70.059
6 - 9	86	57.838	60.819	62.862	65.616	67.951	70.028	72.395
9 - 12	91	61.140	64.627	66.480	69.070	71.179	73.560	75.175
12 - 15	95	64.073	66.462	69.163	71.978	74.713	77.377	79.182
15 - 18	101	65.663	68.460	71.830	74.424	77.291	79.148	82.579
18 - 21	71	69.124	72.208	74.232	76.936	79.164	81.824	83.178
21 - 24	81	71.951	73.747	76.455	79.203	81.951	84.445	86.839
24 - 27	114	73.662	76.365	78.396	81.021	83.456	86.281	88.970
27 - 30	69	72.255	78.101	80.714	83.445	86.176	89.446	92.690
30 - 33	91	78.563	80.512	82.982	85.474	86.501	91.315	95.207
33 - 36	82	73.738	80.646	83.435	86.551	89.470	93.507	97.505
36 - 39	95	80.843	83.813	86.274	88.857	91.537	96.898	98.779
39 - 42	71	80.083	85.452	88.646	91.862	94.360	97.434	102.047
42 - 45	73	84.142	87.394	90.595	93.467	97.335	100.731	105.467
45 - 48	93	85.530	88.694	91.827	95.065	98.111	101.026	103.396
48 - 51	86	87.341	90.610	92.873	95.799	98.134	101.047	104.061
51 - 54	58	86.201	91.048	93.591	97.224	100.819	104.669	108.925
54 - 57	40	91.591	93.365	95.699	98.419	102.223	105.073	109.229
57 - 60	67	91.605	94.767	97.014	101.072	104.537	107.275	109.875
60 - 63	158	88.133	95.185	99.625	103.366	107.417	109.726	115.259

Figure 16: Childrens' height centiles, males, 0-60 months

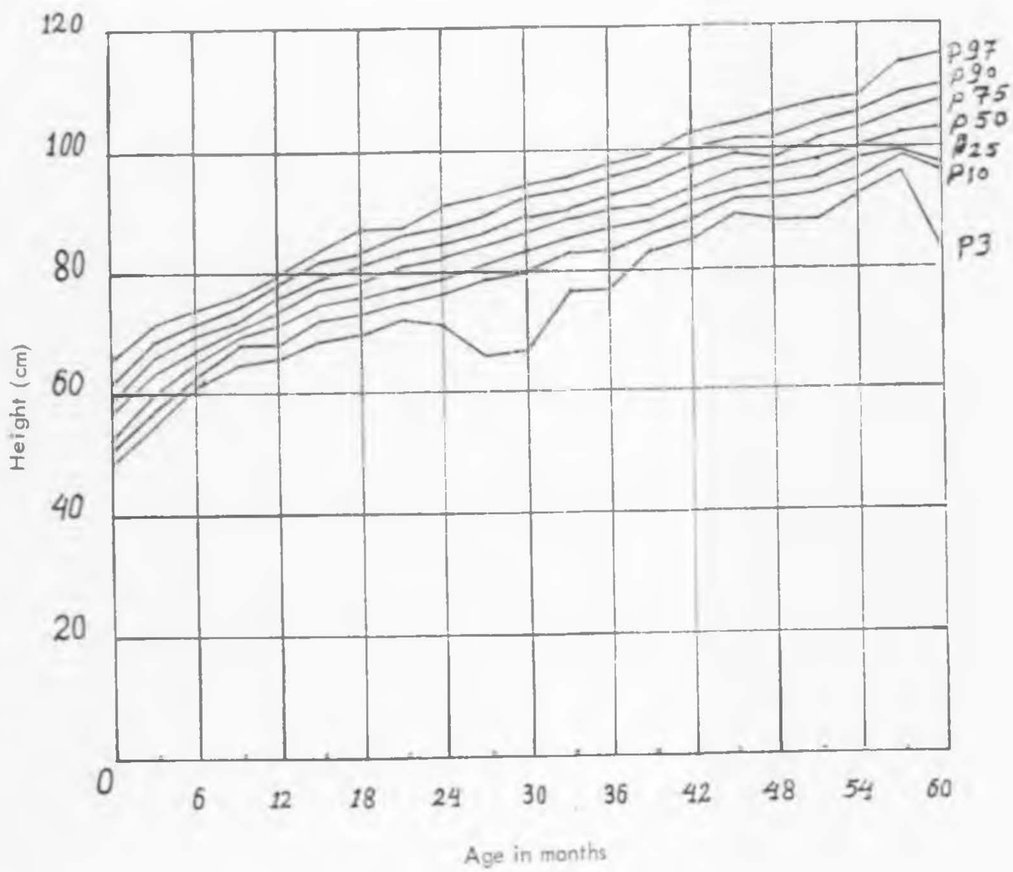


Figure 16: Childrens' height centiles, males, 0-60 months

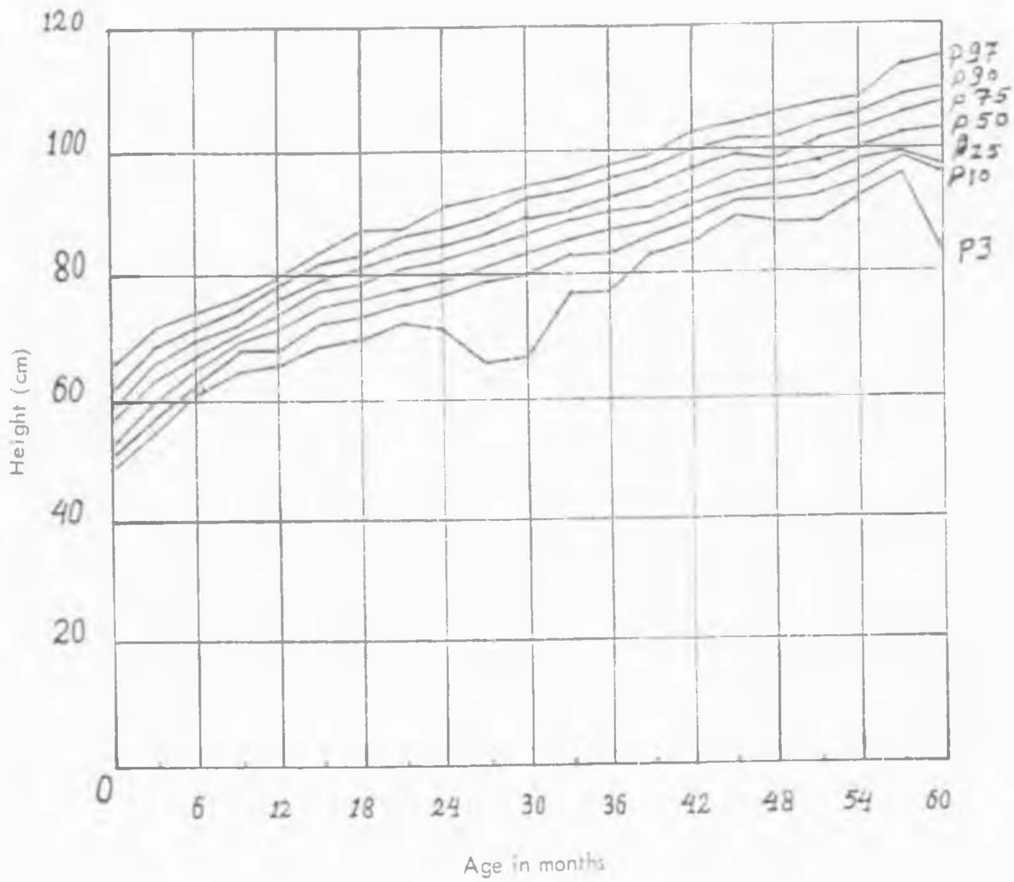


Figure 17 : Childrens' height centiles, females, 0-60 months

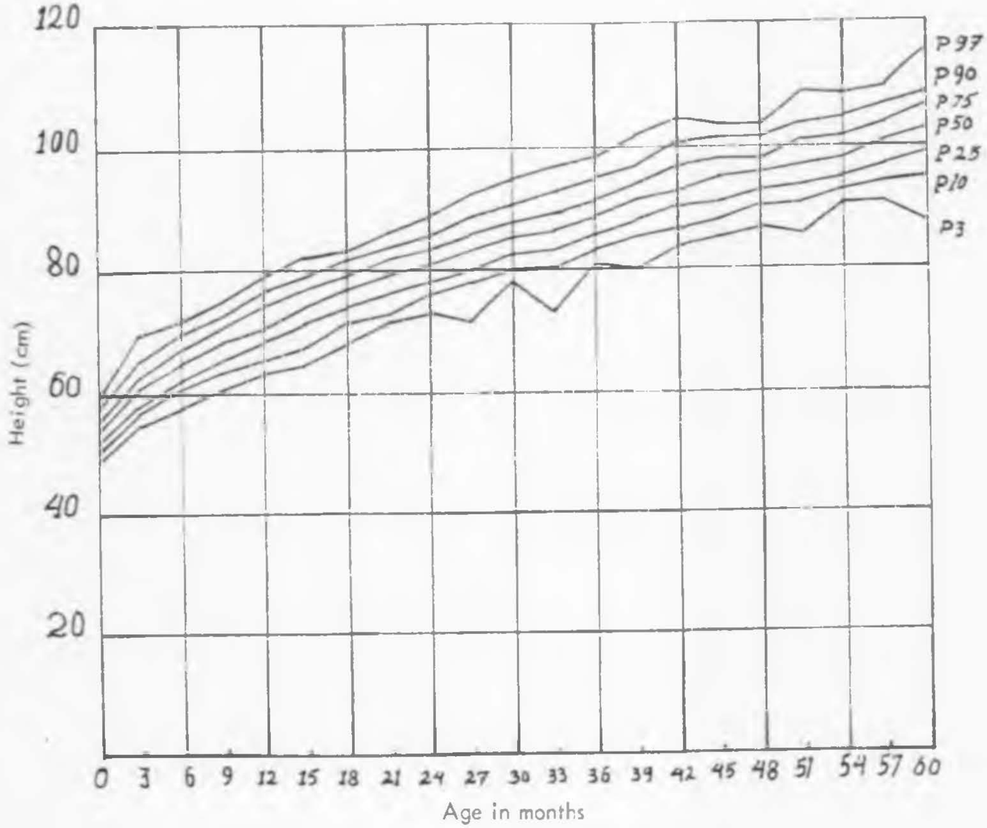


Figure 17 : Childrens' height centiles, females, 0–60 months

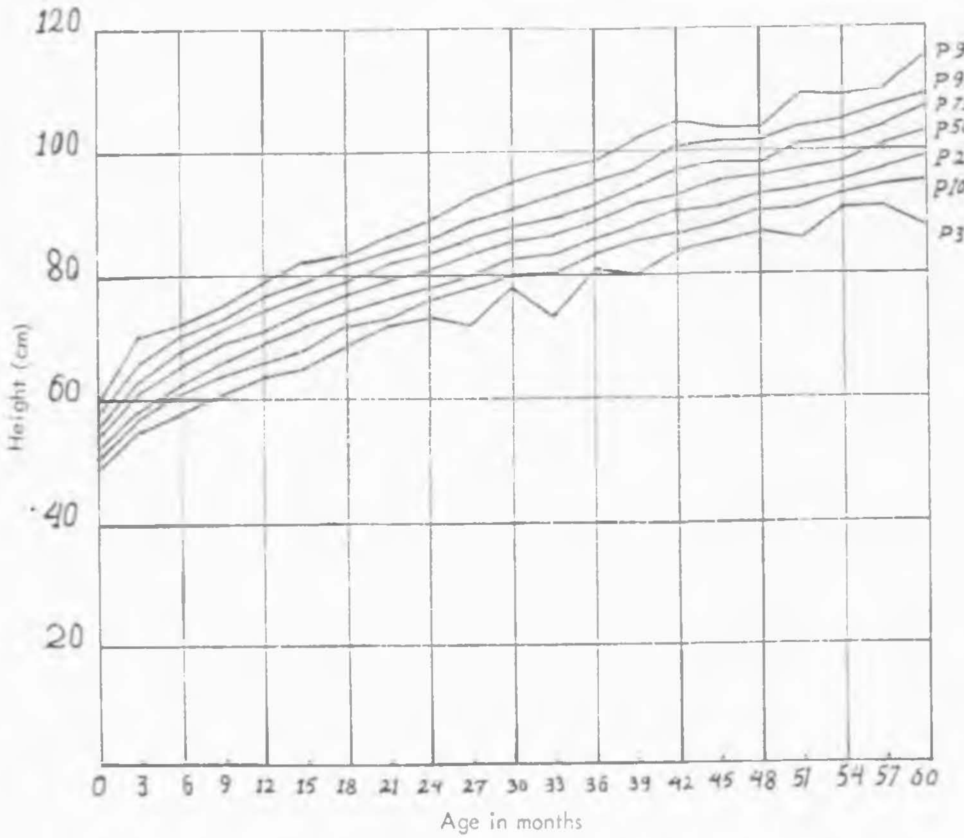


Table 60

MEAN BODY LENGTH (Cm) DURING THE PERIOD 0-60 MONTHS IN JORDAN AND OTHER COUNTRIES

Age (months)	Jordan*	Egypt**	USA***	Jordan*	Egypt**	USA***
0 - 3	56.68	55.04	-	54.80	54.06	-
3 - 6	63.32	62.64	63.4	61.38	61.12	62.35
6 - 9	67.41	67.02	68.8	65.58	65.59	67.65
9 - 12	70.45	70.87	73.2	69.10	69.18	72.15
12 - 15	73.55	73.83	76.85	72.30	71.94	75.9
15 - 18	76.56	75.94	80.15	74.44	74.32	79.25
18 - 24	79.48	78.90	84.65	78.04	77.94	83.75
24 - 30	82.71	82.97	89.80	82.18	82.31	89.0
30 - 36	86.79	88.15	94.15	86.03	87.50	93.55
36 - 48	92.75	95.35	99.80	92.36	94.76	99.45
48 - 60	99.48	102.50	106.05	98.10	101.30	106.15

*This study (1974)

** Abbassy et al. (1972)

*** Nelson (1965)

Figure 18 - Mean body height, 0 - 60 months, males in Jordan and other countries

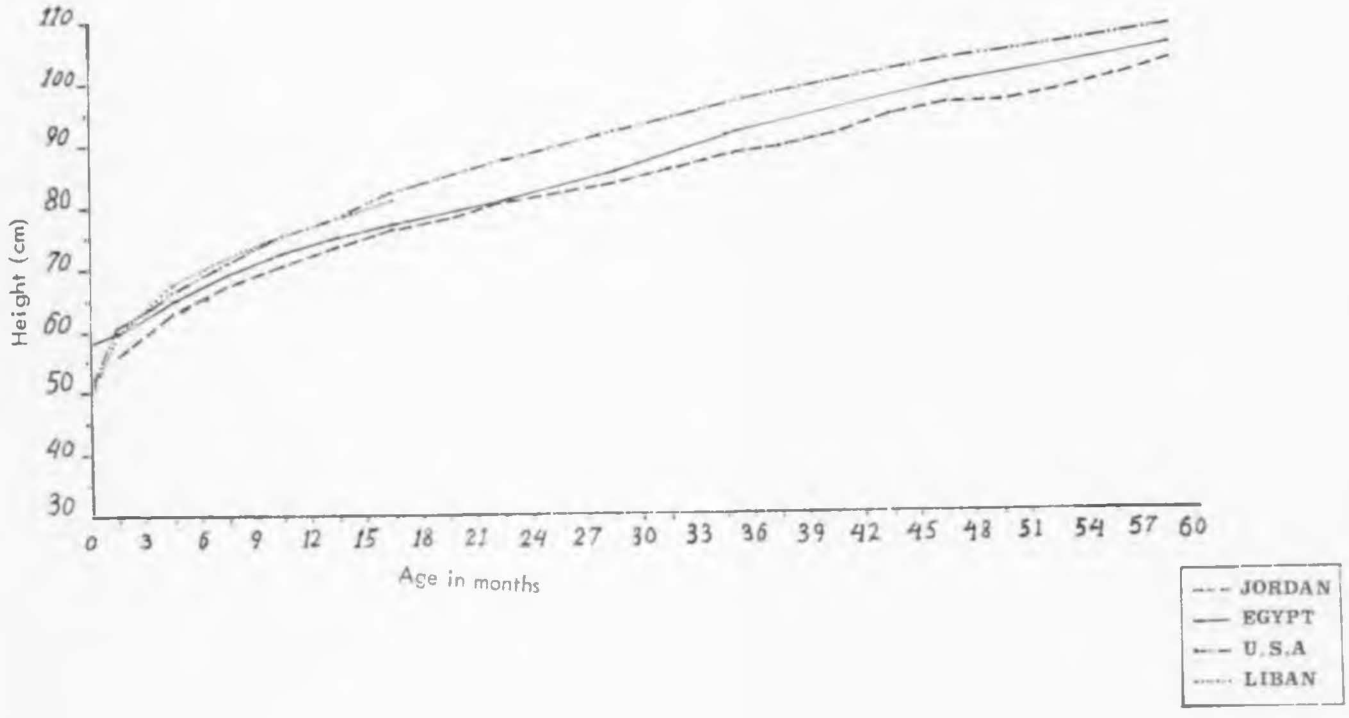


Figure 18 : Mean body height, 0 - 60 months, males in Jordan and other countries

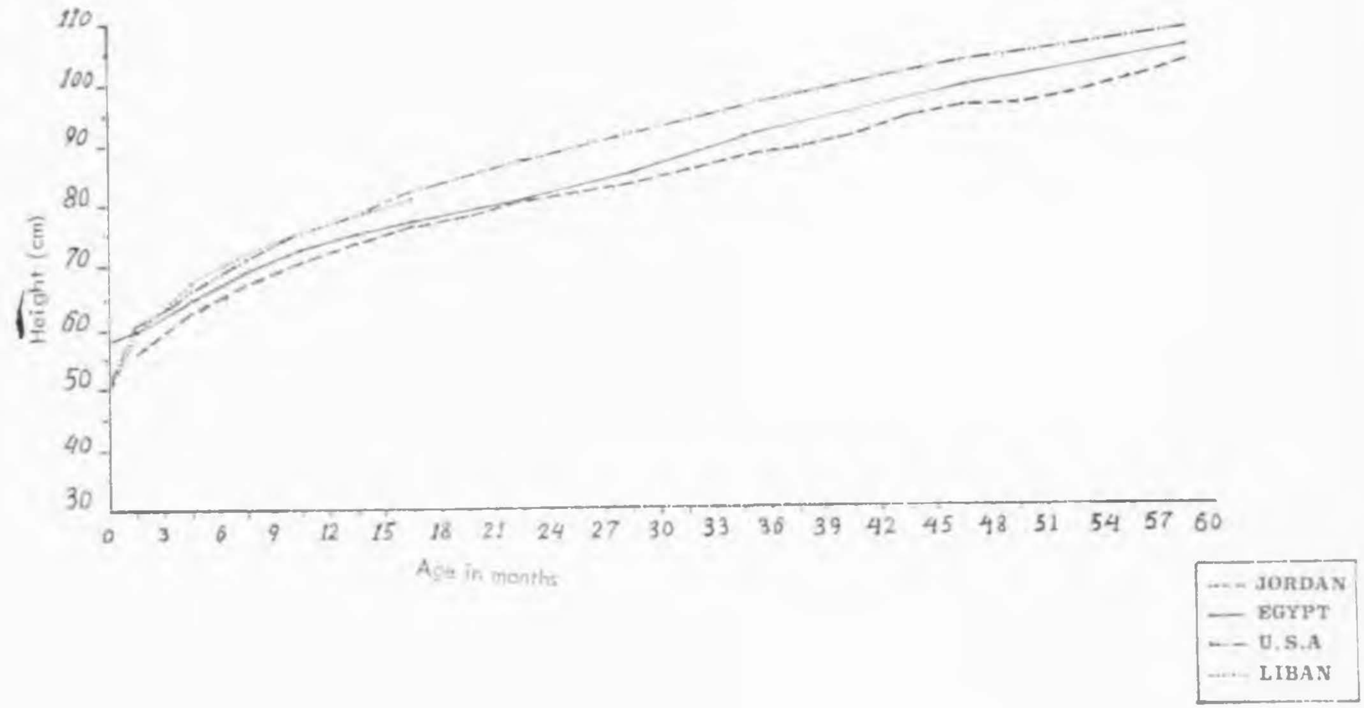


Table 61

INCREMENTS IN THE MEAN BODY LENGTH (Cm) OF JORDANIAN, EGYPTIAN, AMERICAN AND LEBANESE CHILDREN

	Jordanian*		Egyptian**		American***		Lebanese****	
Age (months)	M	F	M	F	M	F	M	F
0 - 3	-	-	9.33	8.04	9.8	9.3	11.4	10.0
3 - 6	6.63	6.57	5.09	5.09	6.0	5.7	6.3	6.0
6 - 9	4.09	4.20	3.84	3.85	4.8	4.9	4.0	4.0
9 - 12	3.03	3.51	3.69	3.33	4.0	4.1	3.4	3.5
12 - 15	3.10	3.20	2.23	2.19	3.3	3.4	3.1	3.1
15 - 18	3.00	2.13	1.99	2.57	3.3	3.3	2.9	2.8
18 - 24	4.11	5.04	3.93	4.67	6.7	5.7	-	-
24 - 30	2.76	3.89	4.21	4.07	4.6	4.8	-	-
30 - 36	4.33	2.97	6.15	6.31	4.1	4.3	-	-
36 - 48	8.63	8.54	8.24	8.21	7.2	7.5	-	-
48 - 60	6.45	5.45	6.07	4.87	5.3	5.9	-	-

*This study (1974)

**Abbassy et al. (1972)

***Nelson (1965)

****Harfouche (1966)

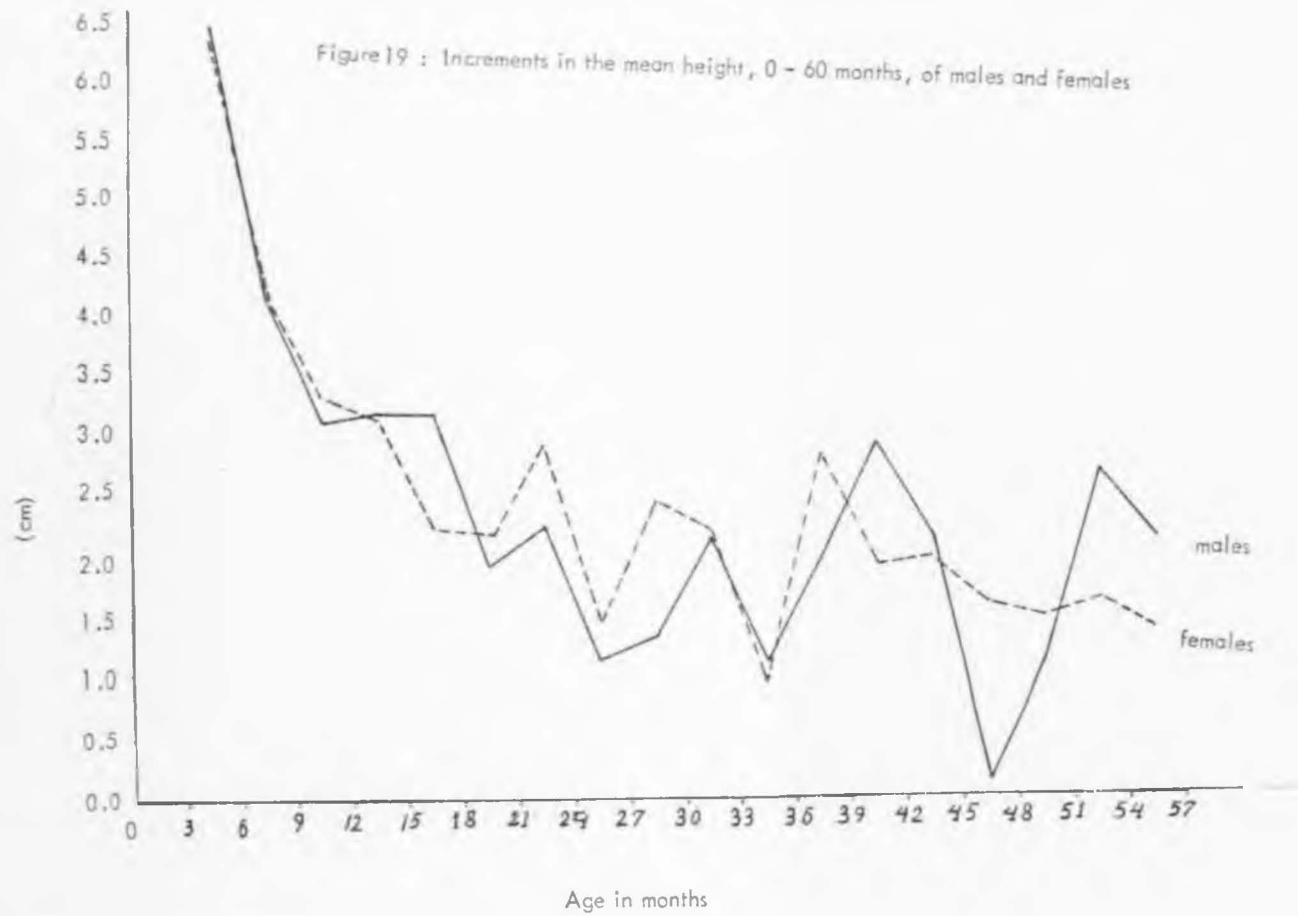
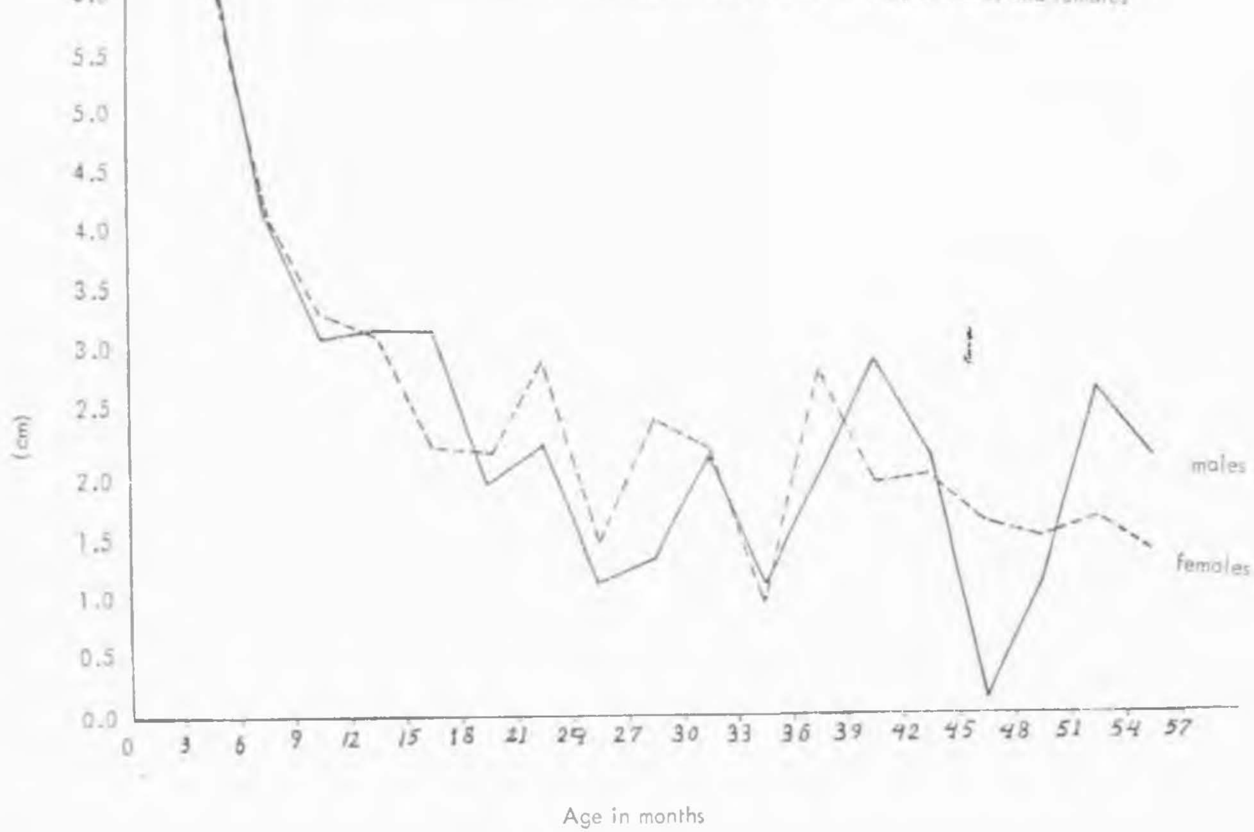


Figure 19 : Increments in the mean height, 0 - 60 months, of males and females

Figure 19 : Increments in the mean height, 0 - 60 months, of males and females



<u>0-5 Years Weight/Height Ratio</u>: Table 62 and figure 20 show the mean weight/height ratio of male and female children according to age.

The pattern of this ratio showed a steady increasing trend by age except at the age interval 21-24 months for males where there was a fall in this ratio. However, in some age groups there was no change in the values at all.

Table 62

MEAN WEIGHT/HEIGHT RATIO (Kg/Cm) BY AGE AND SEX

	Males			Females		
Age (months)	No.	Mean	S.D.	No.	Mean	S.D.
0 - 3	81	0.086	0.013	87	0.078	0.011
3 - 6	84	0.101	0.015	95	0.099	0.015
6 - 9	118	0.115	0.016	85	0.112	0.012
9 - 12	106	0.121	0.015	91	0.116	0.012
12 - 15	102	0.125	0.015	95	0.116	0.013
15 - 18	96	0.125	0.014	100	0.122	0.014
18 - 21	95	0.136	0.021	71	0.125	0.021
21 - 24	93	0.133	0.013	81	0.129	0.016
24 - 27	76	0.136	0.010	114	0.133	0.014
27 - 30	93	0.142	0.025	69	0.136	0.012
30 - 33	83	0.144	0.018	91	0.140	0.011
33 - 36	92	0.145	0.021	82	0.142	0.017
36 - 39	106	0.148	0.016	95	0.144	0.012
39 - 42	78	0.148	0.015	71	0.146	0.013
42 - 45	71	0.153	0.013	73	0.149	0.015
45 - 48	97	0.153	0.013	93	0.149	0.013
48 - 51	80	0.153	0.015	86	0.151	0.014
51 - 54	90	0.156	0.013	58	0.150	0.013
54 - 57	61	0.153	0.014	40	0.153	0.012
57 - 60	65	0.158	0.013	67	0.156	0.014
60 - 63	138	0.163	0.028	158	0.156	0.017

Figure 20 : Weight – height ratio of males and females, 0 – 60 months

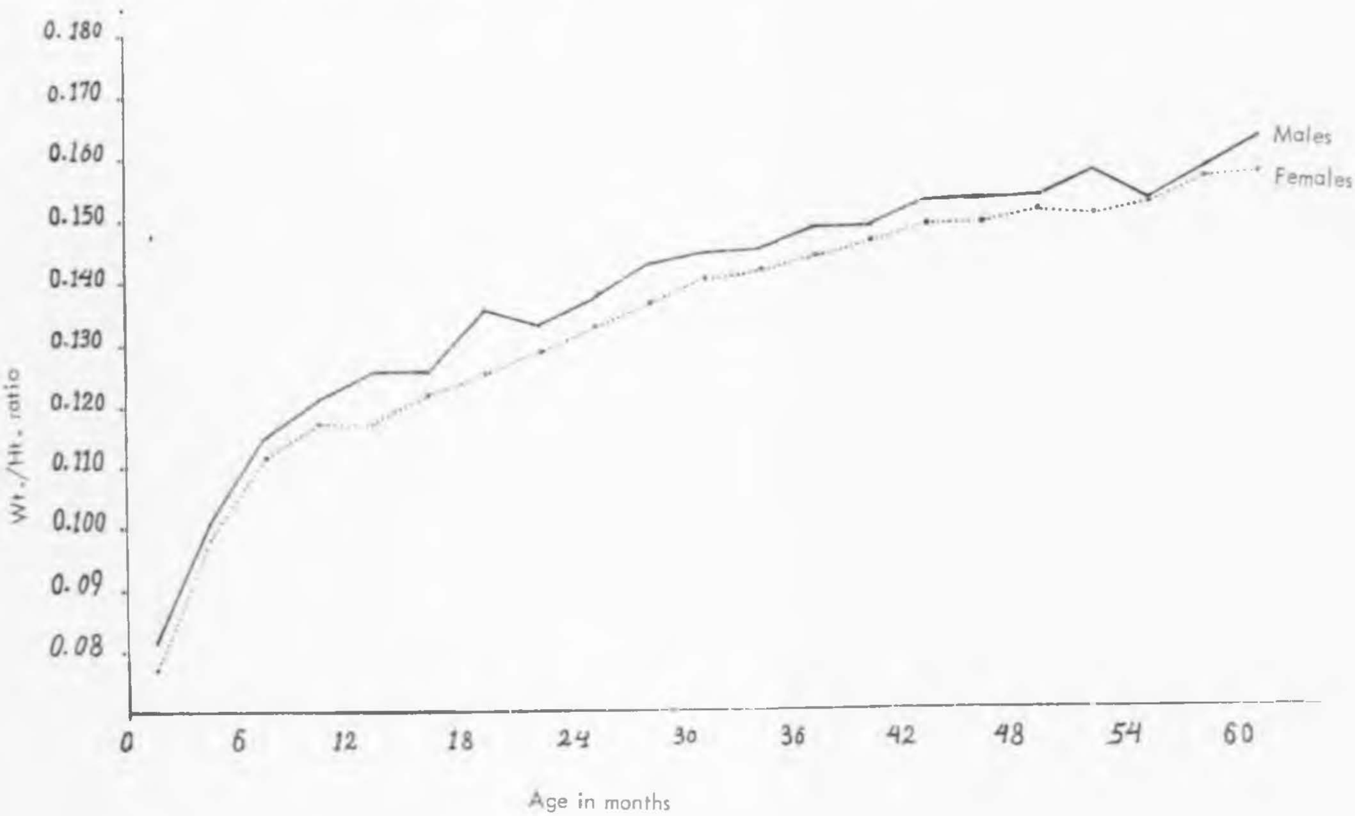
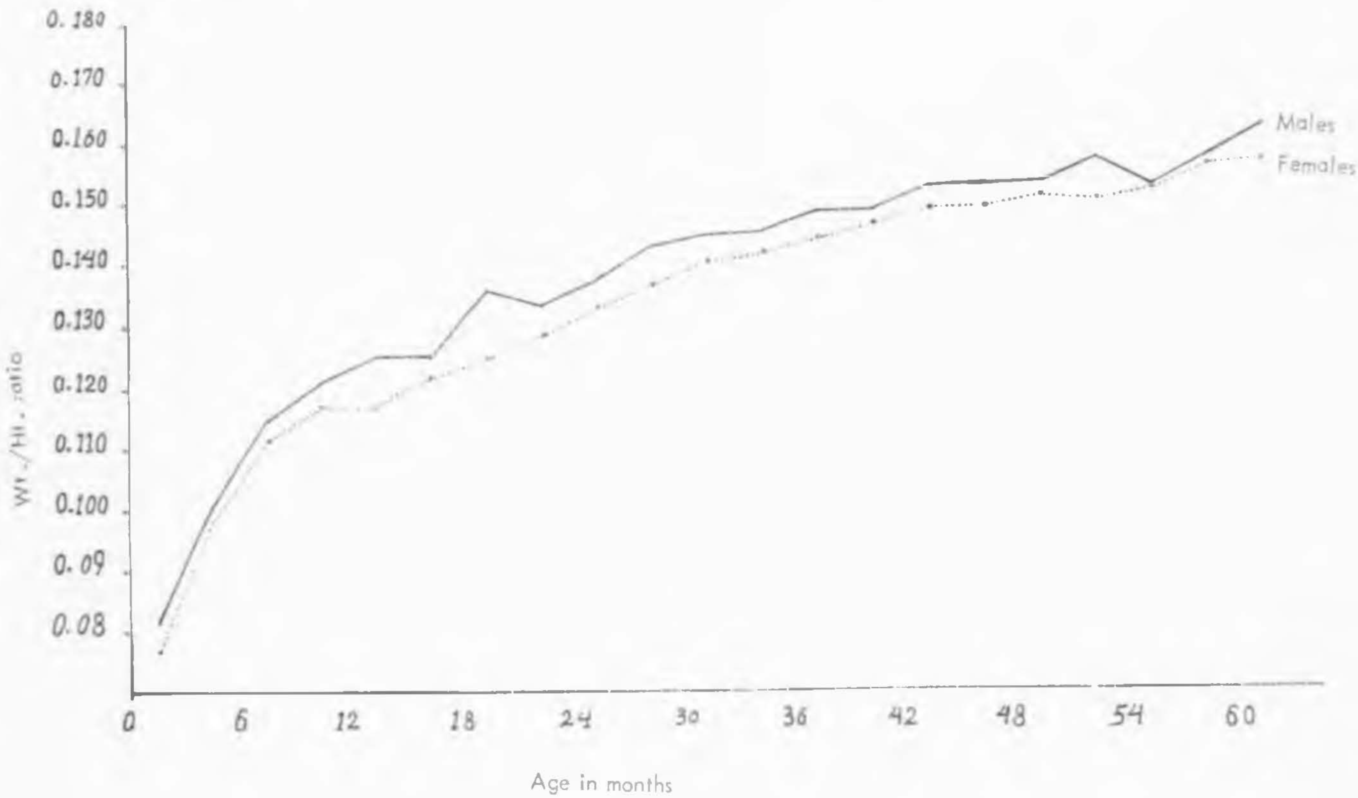


Figure 20 : Weight - height ratio of males and females, 0 - 60 months



<u>0-5 Years Head Circumference Measurements:</u> Table 63 and figure 21 show the mean head circumference of children for males and females.

Tables 64, 65 and figures 22 and 23 show the children's head circumference centiles by age and sex.

Figure 24 show the increments in the mean head circumference of males and females according to age.

Figures 13 and 14 show the 10th, 50th and 90th centiles of 1-24 month old male and female children in this study plotted against Harvard's Standards. The Jordanian children had lower head circumference values especially after the age of six to nine months; the same pattern was also found in weight and height measurements.

The first 12 months of life showed the greatest absolute and relative increase in the head circumference of both sexes. The greatest absolute increase took place during the second three months of life (about 3 cm).

The increase in the head circumference continued relatively high until the age of 12 months, slower until the age of 18 months and either very slow or with no more growth in the following age intervals.

Table 63

CHILDREN'S HEAD CIRCUMFERENCE (Cm) BY AGE AND SEX

Age (months)	Males No.	Males Mean	Males S.D.	Females No.	Females Mean	Females S.D.
0 - 3	81	38.453	2.242	87	37.326	1.908
3 - 6	84	41.499	2.504	95	40.505	2.303
6 - 9	122	43.501	1.601	87	42.054	1.650
9 - 12	107	44.743	1.710	91	43.183	1.601
12 - 15	103	45.266	1.737	96	44.006	1.628
15 - 18	97	45.918	1.476	101	44.780	1.745
18 - 21	97	46.336	1.484	71	44.990	1.450
21 - 24	95	46.877	1.594	83	45.536	1.513
24 - 27	76	46.855	1.465	114	46.144	1.573
27 - 30	94	47.248	1.431	69	46.515	1.737
30 - 33	84	47.548	1.385	91	46.564	1.336
33 - 36	93	47.798	1.731	82	46.876	1.635
36 - 39	107	48.227	1.278	95	47.146	1.541
39 - 42	78	48.105	1.791	72	47.322	1.234
42 - 45	71	48.907	1.241	73	47.521	1.437
45 - 48	97	48.860	1.284	92	47.609	1.511
48 - 51	80	48.688	1.270	85	47.645	2.015
51 - 54	90	49.087	1.243	58	47.734	1.527
54 - 57	62	49.051	1.404	40	48.432	1.504
57 - 60	65	49.336	1.337	67	48.477	1.245
60 - 63	137	49.399	1.683	158	48.502	1.330

Fig. 21 : Mean head circumference for males and females from birth to five years

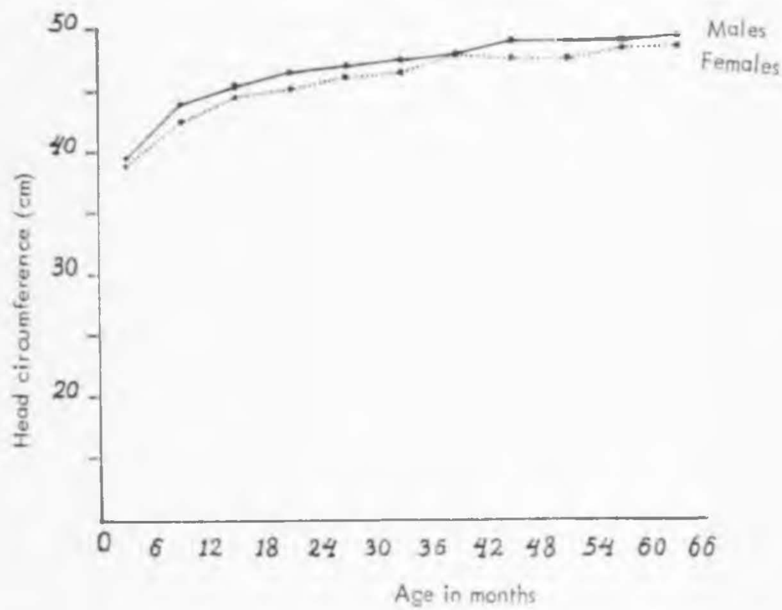


Fig. 21 : Mean head circumference for males and females from birth to five years

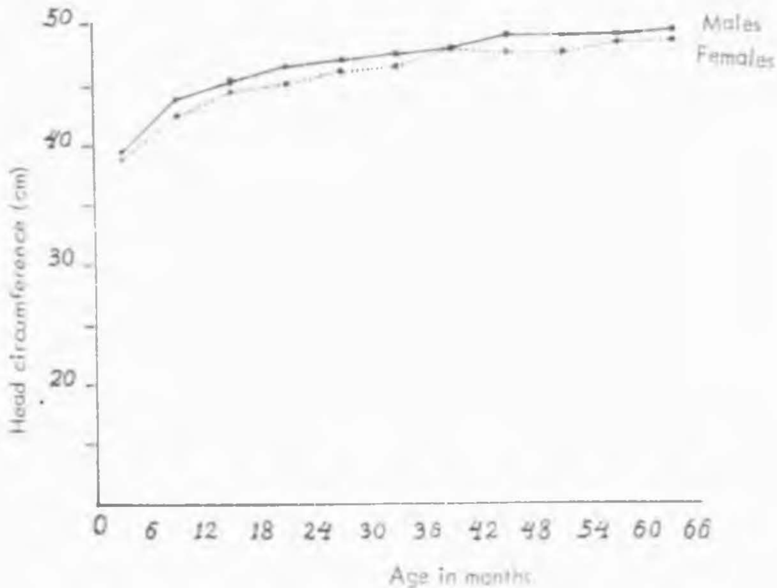


Table 64

CHILDREN'S HEAD CIRCUMFERENCE (CM) PERCENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					MALES			
0 - 3	81	34.550	35.870	36.984	38.419	39.373	40.533	41.617
3 - 6	84	37.816	38.933	39.938	41.042	42.779	44.711	47.514
6 - 9	122	40.193	41.633	42.523	43.384	44.353	45.748	46.769
9 - 12	107	41.644	42.770	43.568	44.756	45.950	46.987	48.591
12 - 15	103	41.107	43.462	44.425	45.249	46.290	47.264	48.700
15 - 18	97	42.748	43.860	45.138	45.957	46.791	47.843	48.943
18 - 21	97	43.420	44.520	45.482	46.576	47.322	48.098	48.902
21 - 24	95	43.391	45.066	45.832	46.903	47.960	47.645	49.913
24 - 27	76	43.598	44.984	46.149	47.099	47.857	48.414	49.052
27 - 30	94	43.857	45.431	46.568	47.252	48.081	48.952	49.975
30 - 33	84	44.536	45.947	46.825	47.658	48.444	49.081	49.877
33 - 36	93	44.803	45.726	46.659	47.761	48.912	49.919	51.203
36 - 39	107	45.601	46.544	47.375	48.051	49.045	49.941	50.774
39 - 42	78	44.733	45.816	47.140	48.352	49.072	50.217	51.330
42 - 45	71	46.354	47.289	47.928	48.874	49.923	50.673	51.040
45 - 48	97	46.435	47.250	48.087	48.907	49.617	50.595	51.061
48 - 51	80	45.947	46.875	47.822	48.762	49.677	50.378	50.975
51 - 54	90	46.422	47.284	48.353	49.073	50.047	50.822	51.444
54 - 57	62	46.625	47.299	48.043	48.976	50.124	51.009	51.732
57 - 60	65	46.319	47.629	48.471	49.180	50.351	51.020	51.715
60 - 63	137	45.916	47.368	48.361	49.508	50.496	51.281	51.938

TABLE NUMBER 221
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CHILDREN'S HEAD CIRCUMFERENCE (CM) PERCENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					F E M A L E S			
0 - 3	87	34.204	34.986	36.013	37.075	38.301	39.402	40.932
3 - 6	95	37.328	38.124	38.965	40.112	41.429	42.743	47.375
6 - 9	87	38.105	40.260	41.074	41.946	42.980	44.310	45.146
9 - 12	91	40.169	41.384	42.202	43.181	44.185	45.259	46.211
12 - 15	96	40.857	42.015	42.962	43.958	44.902	46.022	47.841
15 - 18	101	41.225	42.590	43.818	44.897	45.831	46.741	48.249
18 - 21	71	42.504	43.186	43.936	44.972	46.038	46.839	47.273
21 - 24	83	42.691	43.468	44.451	45.645	46.619	47.423	48.614
24 - 27	114	42.950	44.002	45.069	46.123	47.222	48.163	49.149
27 - 30	69	43.017	44.388	45.602	46.501	47.192	48.062	51.433
30 - 33	91	43.867	44.842	45.697	46.536	47.302	48.391	49.518
33 - 36	82	43.923	45.080	45.800	46.726	47.934	48.993	50.443
36 - 39	95	44.304	45.298	46.402	47.401	48.034	48.868	49.814
39 - 42	72	44.980	45.699	46.474	47.383	48.303	48.951	49.484
42 - 45	73	44.995	45.777	46.574	47.480	48.569	49.479	50.435
45 - 48	92	44.834	45.767	46.687	47.612	48.539	49.667	50.572
48 - 51	85	43.055	45.403	46.416	47.738	48.931	50.265	51.473
51 - 54	58	44.972	45.664	46.564	47.655	48.580	49.631	51.268
54 - 57	40	46.354	46.738	47.431	48.169	49.401	50.652	51.527
57 - 60	67	46.019	46.647	47.486	48.501	49.172	50.321	50.884
60 - 63	158	45.966	46.744	47.566	48.481	49.469	50.138	50.921

Fig. 22 : Children's head circumference centiles, 0 - 60 months, males

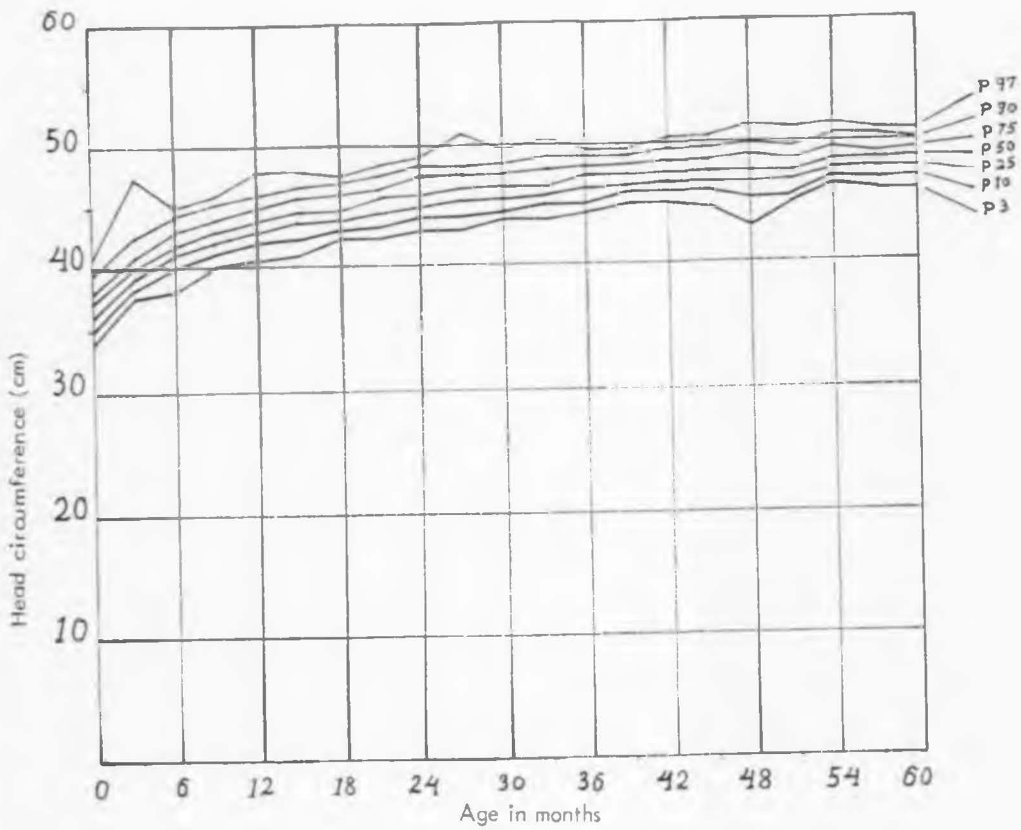


Fig. 22 : Children's head circumference centiles, 0 - 60 months, males

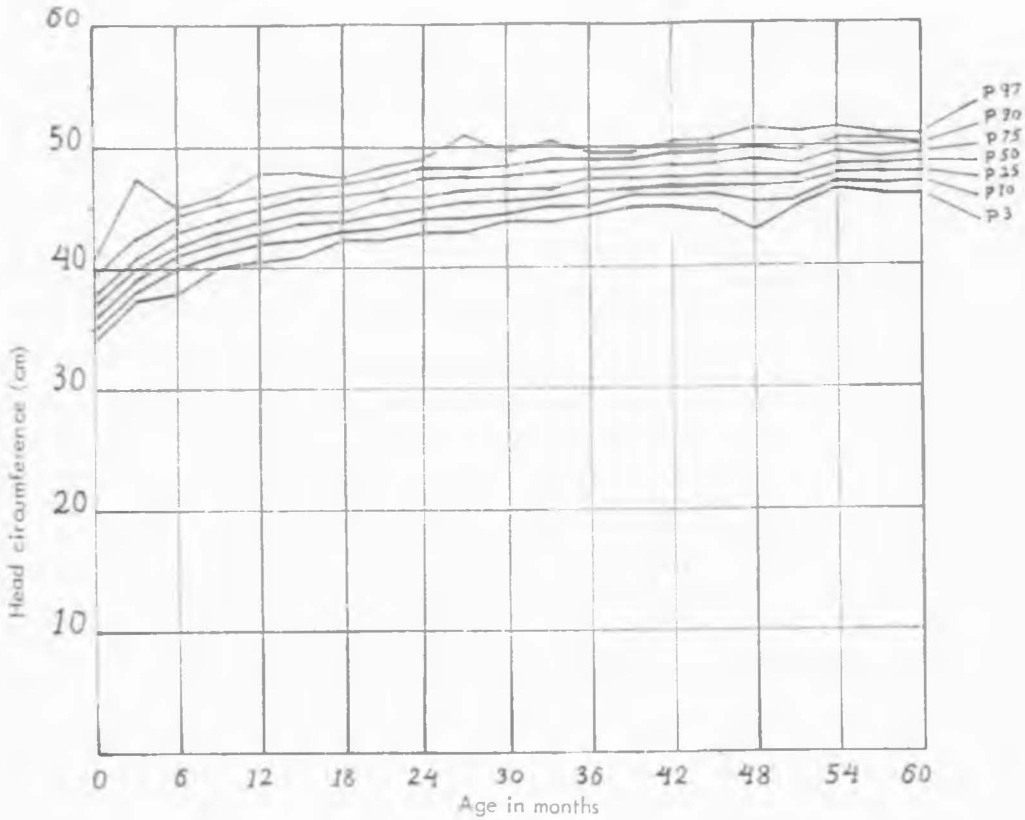


Fig.23 : Children's head circumference centiles, 0 - 60 months, females

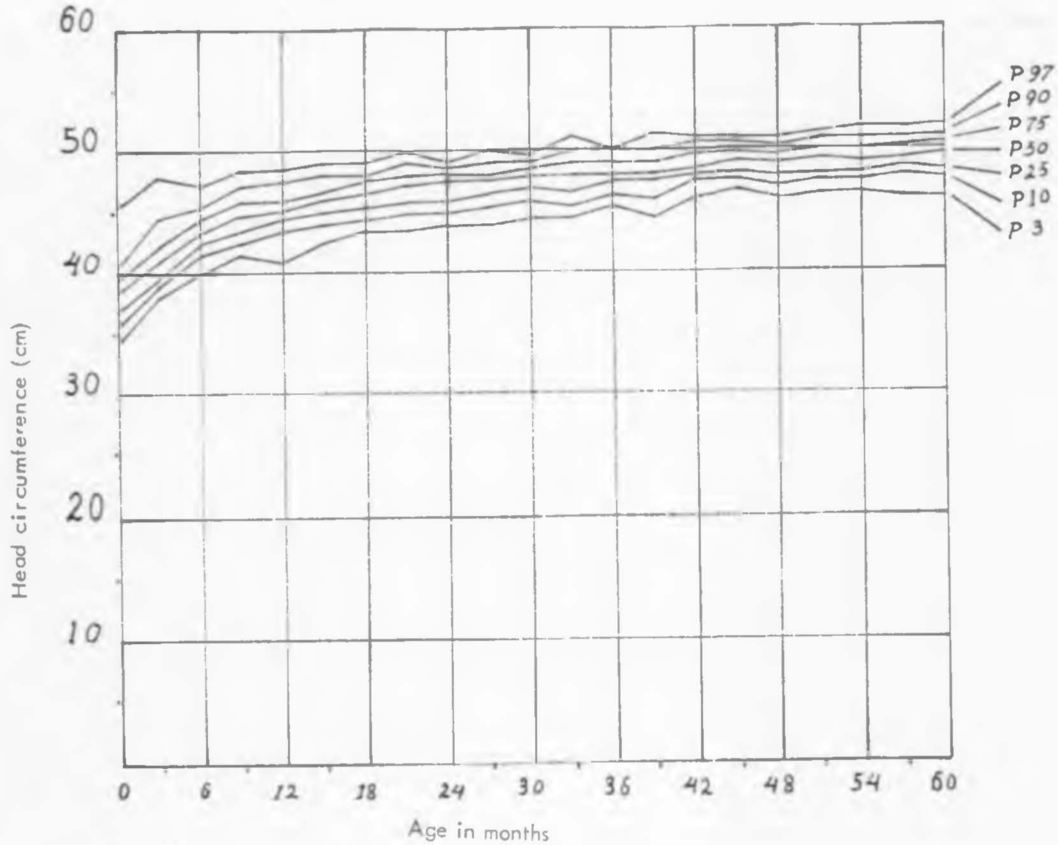


Fig. 23 : Children's head circumference centiles, 0 - 60 months, females

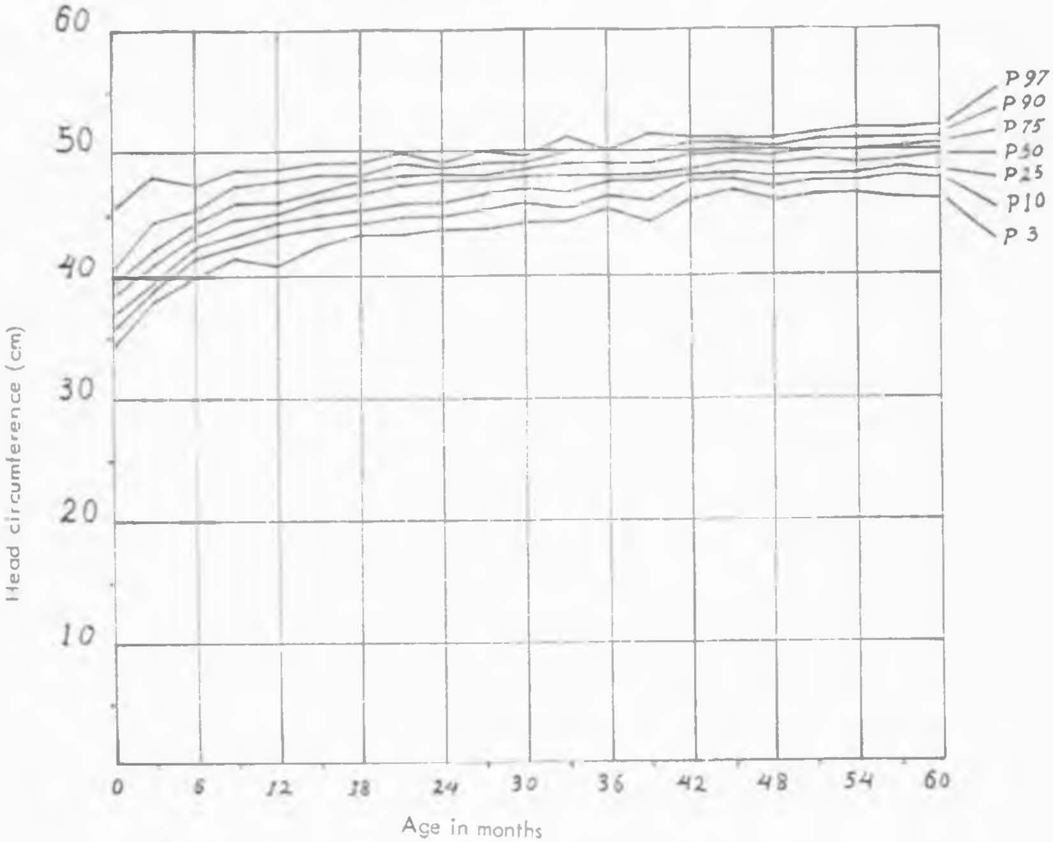


Fig. 24: Increments in the mean head circumference, 0 – 60 months of males and females

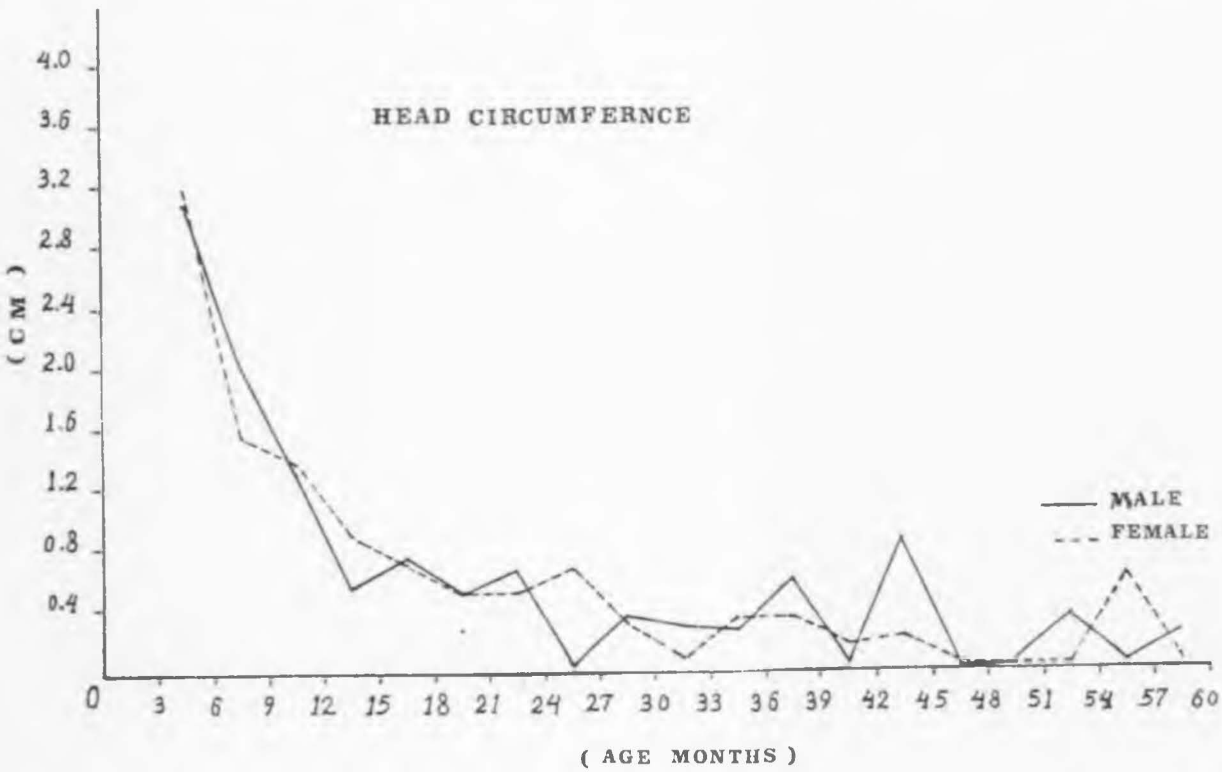
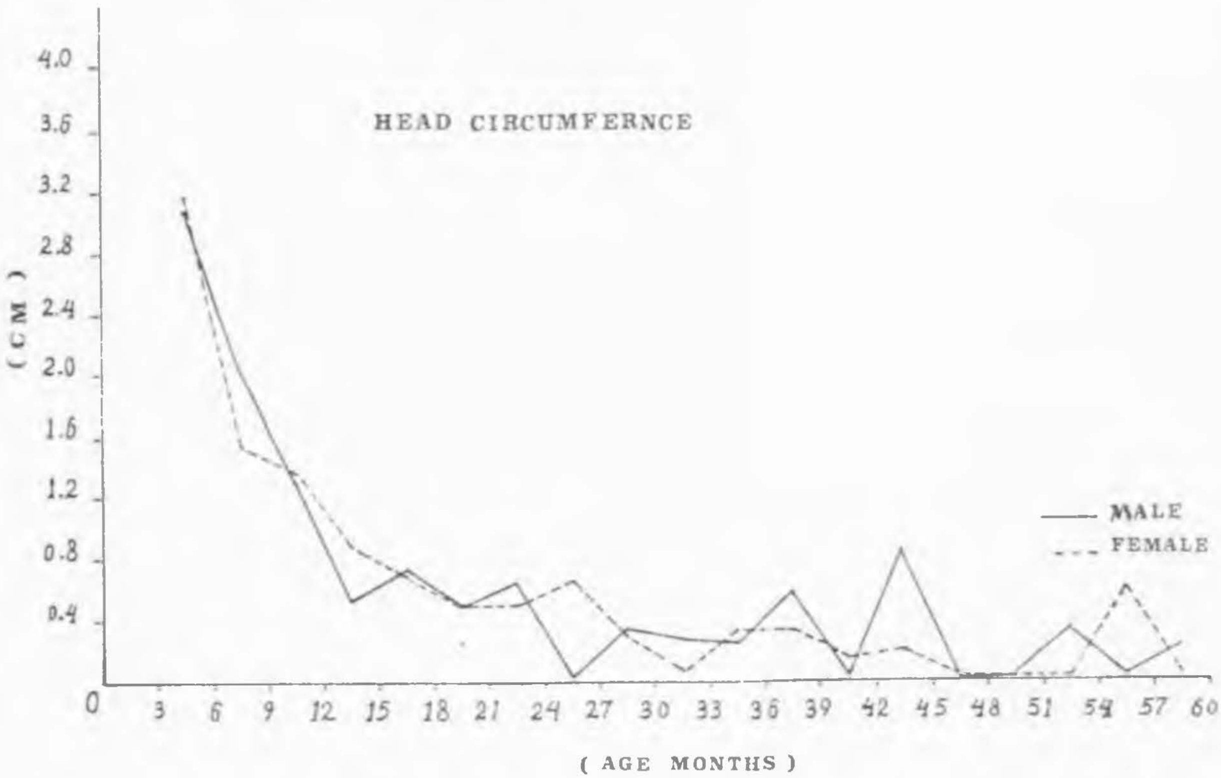


Fig. 24: Increments in the mean head circumference, 0 - 60 months of males and females



<u>0-5 Years Arm Circumference</u>: Table 66 and figure 25 show the mean arm circumference of children by age and sex. Figures 26 and 27 show the childrens' arm circumference centiles by age and sex. Table 67 shows the centiles for males and Table 68 shows the centiles for females.

The growth pattern of arm circumference showed that there was a rapid trend in growth during the first 12 months of life followed by a relatively slower trend which continued until the age of 15 months. However, growth in the subsequent ages was relatively slower. Increments in the mean arm circumference are shown in figure 28.

Arm circumference showed the highest absolute increment at the age of six months.

Figures 29 and 30 show the arm circumference of male and female children in this study compared to the standard (Jelliffe, 1966). The pattern of growth is similar, however, the Jordanian values were lower.

Table 66

CHILDREN'S ARM CIRCUMFERENCE (Cm) BY AGE AND SEX

	Males			Females		
Age (months)	No.	Mean	S.D.	No.	Mean	S.D.
0 - 3	80	11.951	1.356	87	11.303	1.413
3 - 6	84	12.760	1.456	95	12.756	1.244
6 - 9	122	13.682	1.367	87	13.166	1.135
9 - 12	107	13.918	1.221	89	13.660	1.123
12 - 15	103	14.099	1.309	96	13.521	1.338
15 - 18	96	13.943	1.263	101	13.495	1.185
18 - 21	97	14.362	1.139	71	13.818	1.154
21 - 24	95	14.335	1.025	83	14.055	1.206
24 - 27	76	14.546	0.977	114	14.372	1.252
27 - 30	94	14.684	1.168	68	14.569	1.441
30 - 33	84	14.796	1.101	92	14.984	0.998
33 - 36	93	14.992	1.069	82	14.854	1.411
36 - 39	107	15.028	1.114	94	15.158	1.259
39 - 42	76	15.156	1.126	71	15.160	1.138
42 - 45	71	15.425	1.229	72	15.373	1.186
45 - 48	97	15.389	1.010	93	15.283	1.134
48 - 51	80	15.156	1.050	85	15.482	1.183
51 - 54	90	15.545	1.193	58	15.348	1.345
54 - 57	61	15.419	1.306	40	15.159	1.088
57 - 60	65	15.564	1.011	67	15.599	1.158
60 - 63	136	15.481	1.163	158	15.548	1.266

Figure 25 : Mean arm circumference for males and females from birth to five years

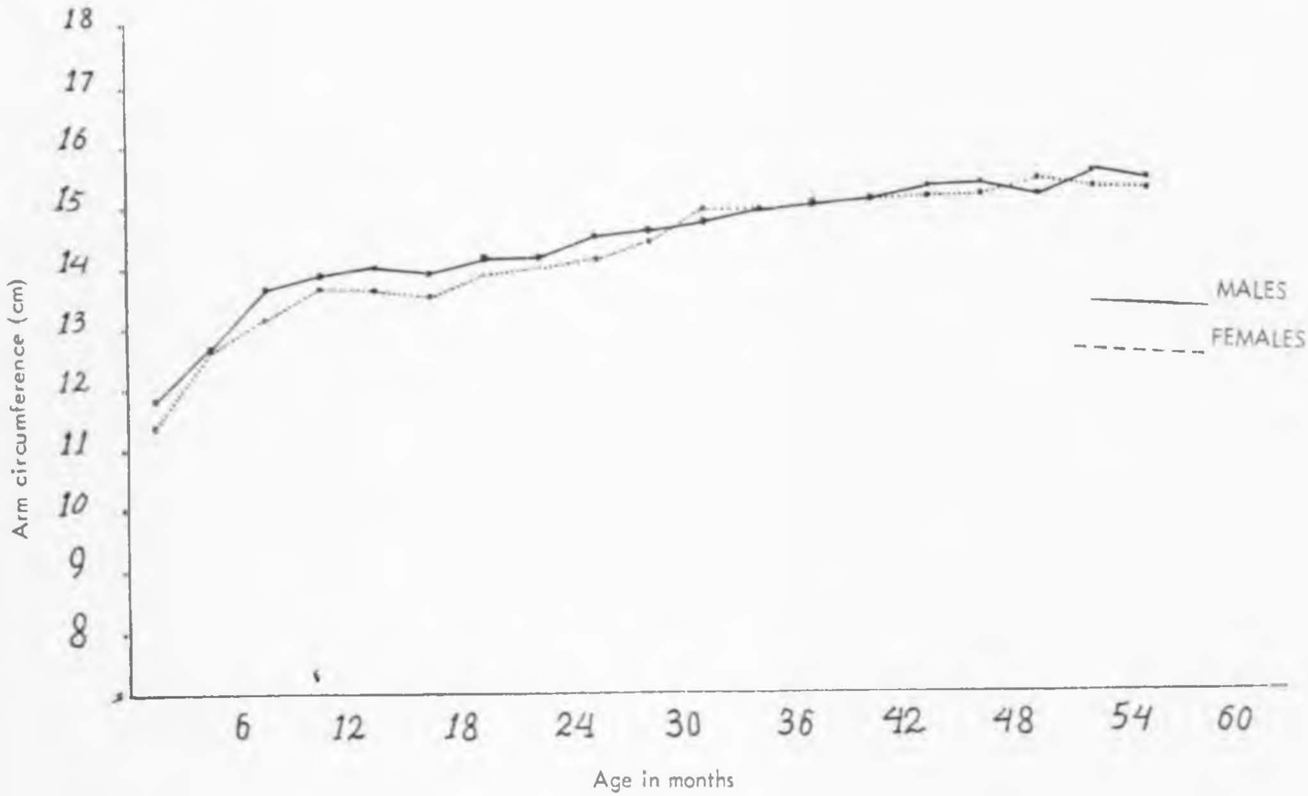


Figure 25 : Mean arm circumference for males and females from birth to five years

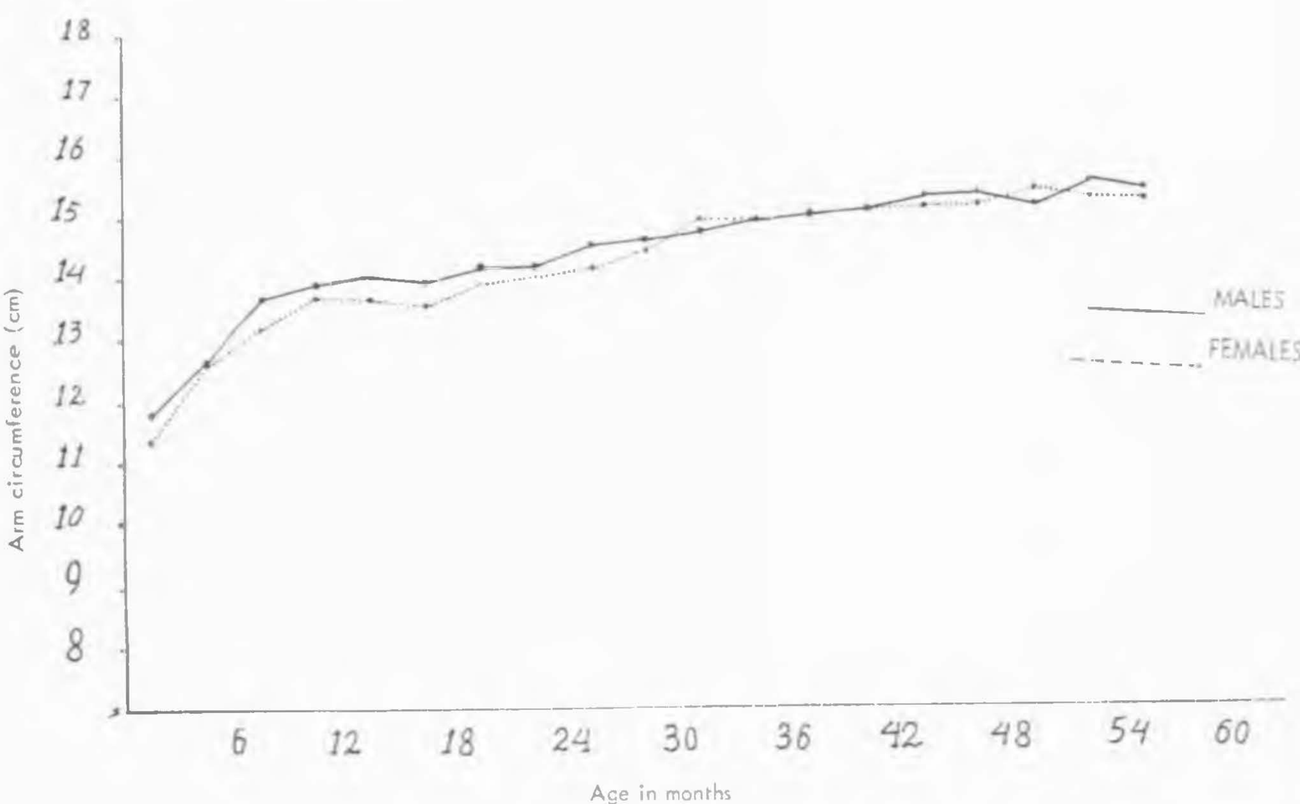


Table 67

CHILDREN'S ARM CIRCUMFERENCE (CM) PERCENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					MALES			
0 - 3	80	9.134	10.163	11.170	12.129	12.769	13.645	14.730
3 - 6	84	9.371	10.748	11.844	12.904	13.805	14.597	15.08[illegible]
6 - 9	122	11.205	11.939	12.816	13.761	14.566	15.335	16.37[illegible]
9 - 12	107	11.384	12.379	13.271	13.986	14.658	15.307	16.134
12 - 15	103	11.986	12.460	13.135	14.023	14.909	15.659	16.870
15 - 18	96	11.583	12.351	13.281	14.002	14.777	15.184	16.080
18 - 21	97	12.309	12.946	13.545	14.334	15.193	15.735	16.443
21 - 24	95	12.775	13.249	13.647	14.186	14.895	15.610	16.687
24 - 27	76	12.639	13.455	13.887	14.441	15.081	15.911	16.521
27 - 30	94	12.459	13.299	13.891	14.745	15.398	16.138	17.156
30 - 33	84	12.593	13.447	14.081	14.801	15.922	16.143	16.941
33 - 36	93	13.203	13.813	14.308	14.926	15.631	16.435	17.048
36 - 39	107	13.292	13.652	14.173	15.045	15.721	16.385	17.104
39 - 42	76	13.172	13.906	14.352	14.961	15.742	16.387	17.784
42 - 45	71	13.148	13.966	14.551	15.292	16.249	17.035	17.590
45 - 48	97	13.468	14.017	14.749	15.309	16.063	16.711	17.074
48 - 51	80	13.395	13.810	14.386	15.111	15.789	16.563	17.08[illegible]
51 - 54	90	13.399	14.329	14.865	15.540	16.101	16.962	17.767
54 - 57	61	13.420	13.874	14.397	15.180	16.256	17.048	17.705
57 - 60	65	13.828	14.140	14.740	15.581	16.121	16.945	17.49[illegible]
60 - 63	136	13.415	14.025	14.583	15.452	16.302	17.008	17.456

Table 63

CHILDREN'S ARM CIRCUMFERENCE (CM) PERCENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					FEMALES			
0 - 3	87	8.878	9.725	10.390	11.343	12.114	13.015	13.865
3 - 6	95	10.927	11.282	11.798	12.709	13.511	14.215	15.29[illegible]
6 - 9	87	11.079	11.809	12.278	13.142	13.948	14.[illegible]01	15.16[illegible]
9 - 12	89	11.915	12.186	12.858	13.612	14.389	15.149	15.965
12 - 15	96	10.383	11.806	12.869	13.521	14.401	15.[illegible]1	15.94[illegible]
15 - 18	101	10.659	12.325	12.834	13.521	14.267	14.[illegible]53	15.523
18 - 21	71	11.548	12.142	13.068	13.783	14.764	15.129	15.987
21 - 24	83	12.043	12.460	13.208	13.989	14.931	15.506	16.467
24 - 27	114	12.136	12.601	13.770	14.337	15.096	15.981	16.60[illegible]
27 - 30	68	12.450	13.021	13.555	14.380	15.442	16.549	17.441
30 - 33	92	13.357	13.831	14.273	14.867	15.522	16.241	17.006
33 - 36	82	12.501	13.111	14.109	14.753	15.717	16.690	17.035
36 - 39	94	13.144	13.715	14.121	14.999	16.129	16.771	17.476
39 - 42	71	12.668	13.463	14.431	15.184	15.964	16.499	17.107
42 - 45	72	13.305	13.859	14.530	15.202	16.109	17.107	17.589
45 - 48	93	13.203	13.957	14.472	15.098	15.989	16.786	17.662
48 - 51	85	13.184	14.032	14.686	15.485	16.104	17.047	[illegible].159
51 - 54	58	13.179	13.987	14.482	15.114	16.203	17.029	17.517
54 - 57	40	13.774	13.942	14.295	14.916	15.687	16.891	17.565
57 - 60	67	13.767	14.269	14.671	15.532	16.347	16.961	18.099
60 - 63	158	13.134	14.049	14.788	15.451	16.325	17.025	17.917

Figure 26 : centiles for arm circumference, males, 0 - 60 months

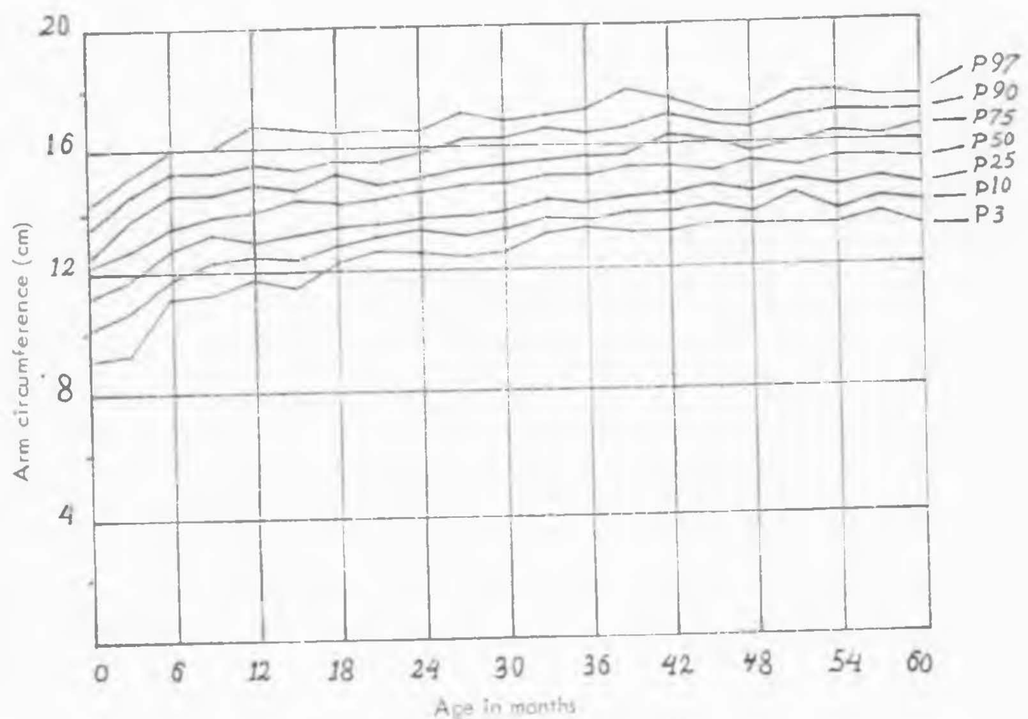


Figure 26 : centiles for arm circumference, males, 0 - 60 months

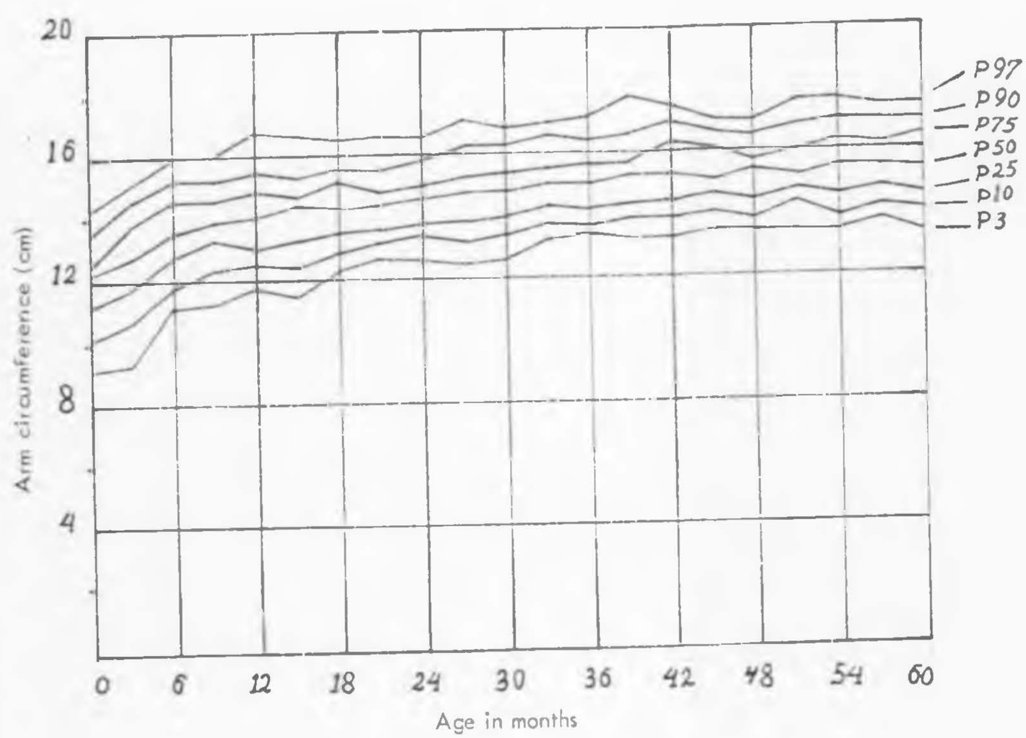


Figure 27 : centiles for arm circumference, females, 0 - 60 months

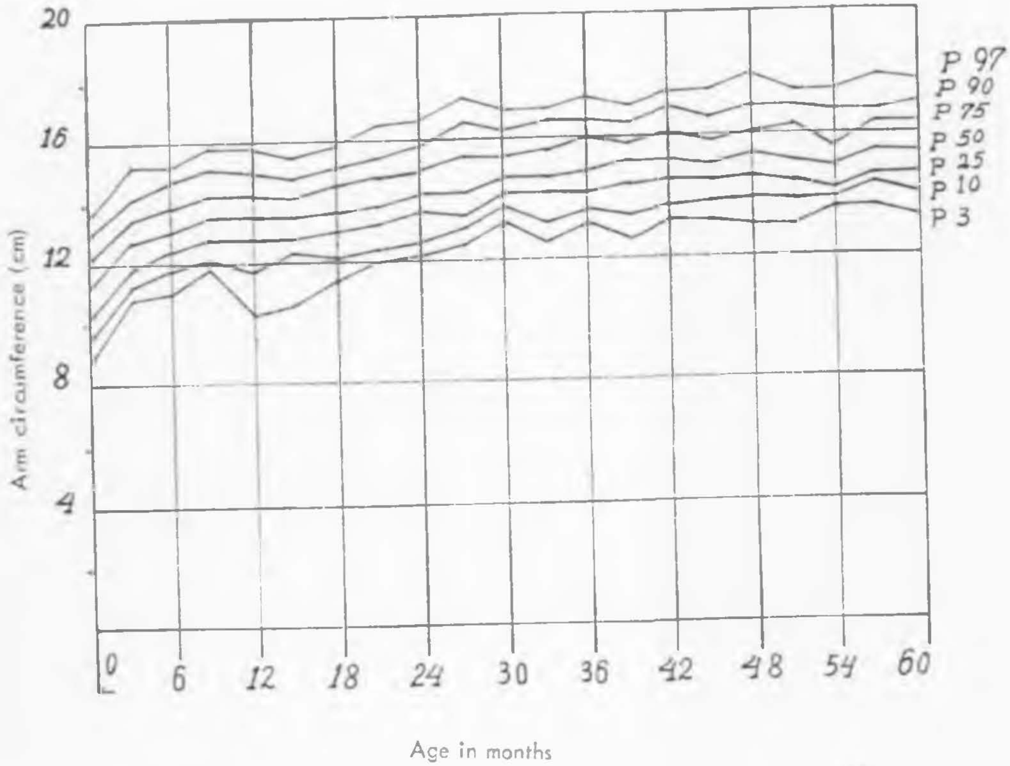


Figure 27 : centiles for arm circumference, females, 0 - 60 months

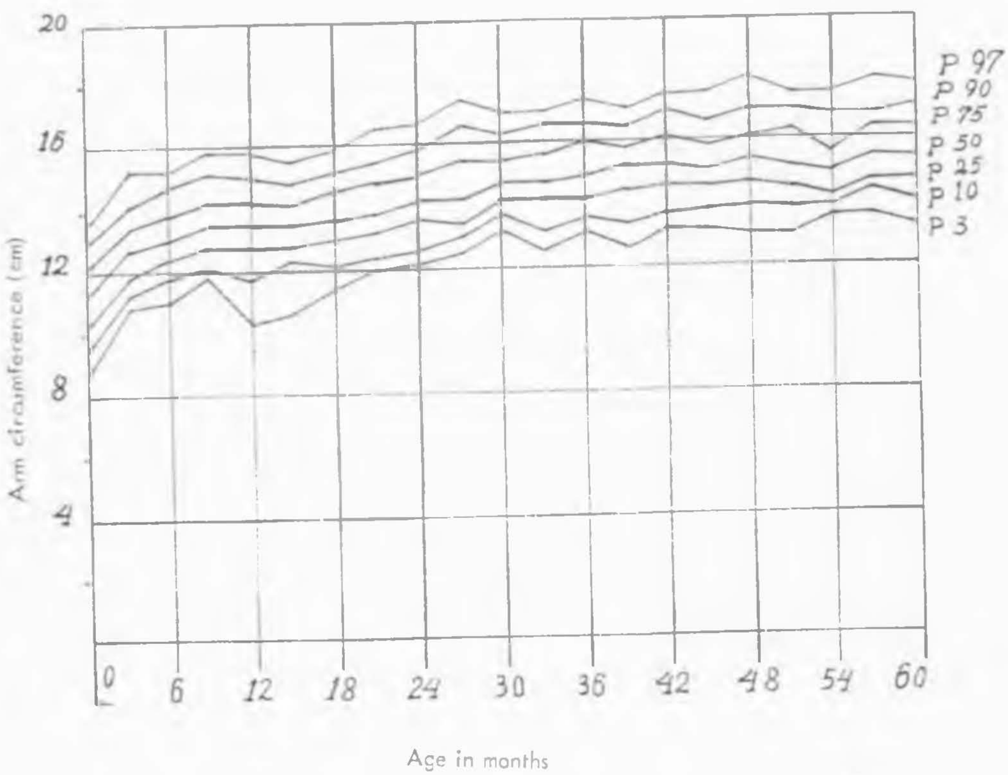


Figure 28 : Increments in the mean arm circumference, 0 - 60 months, of males and females

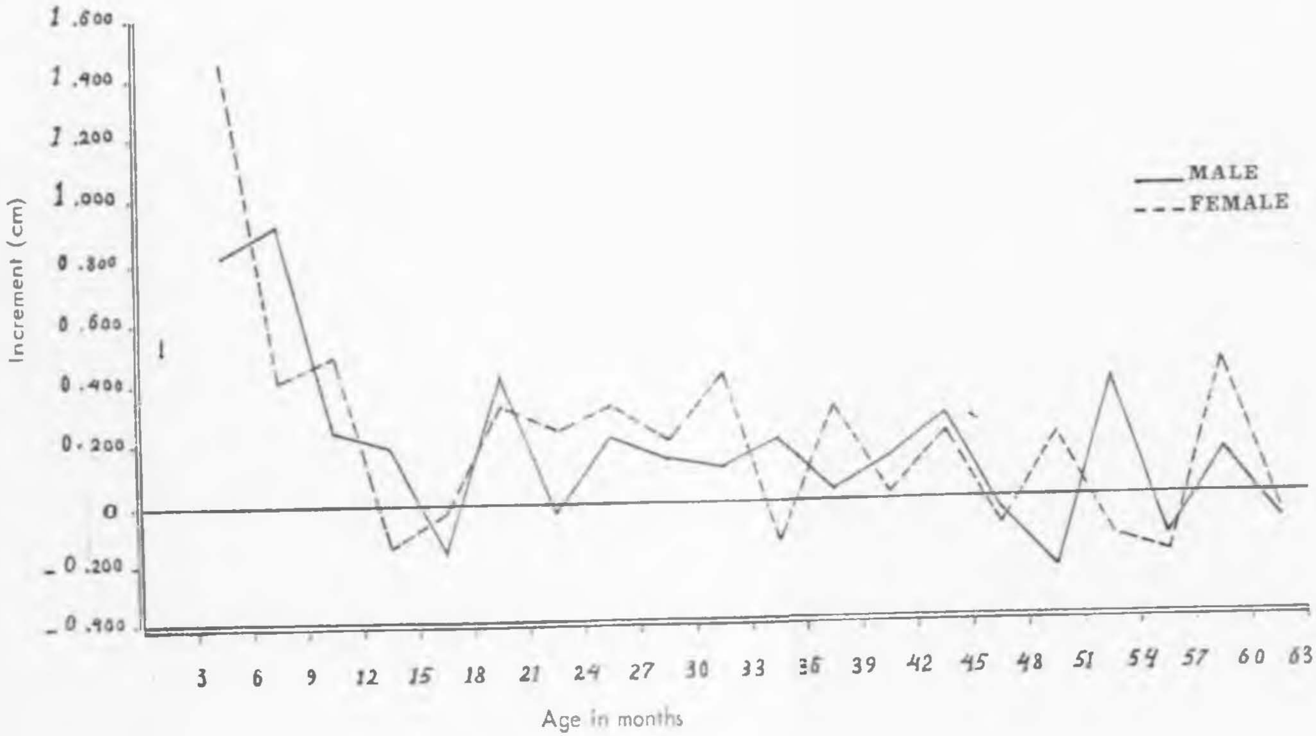


Figure 28 : Increments in the mean arm circumference, 0 - 60 months, of males and females

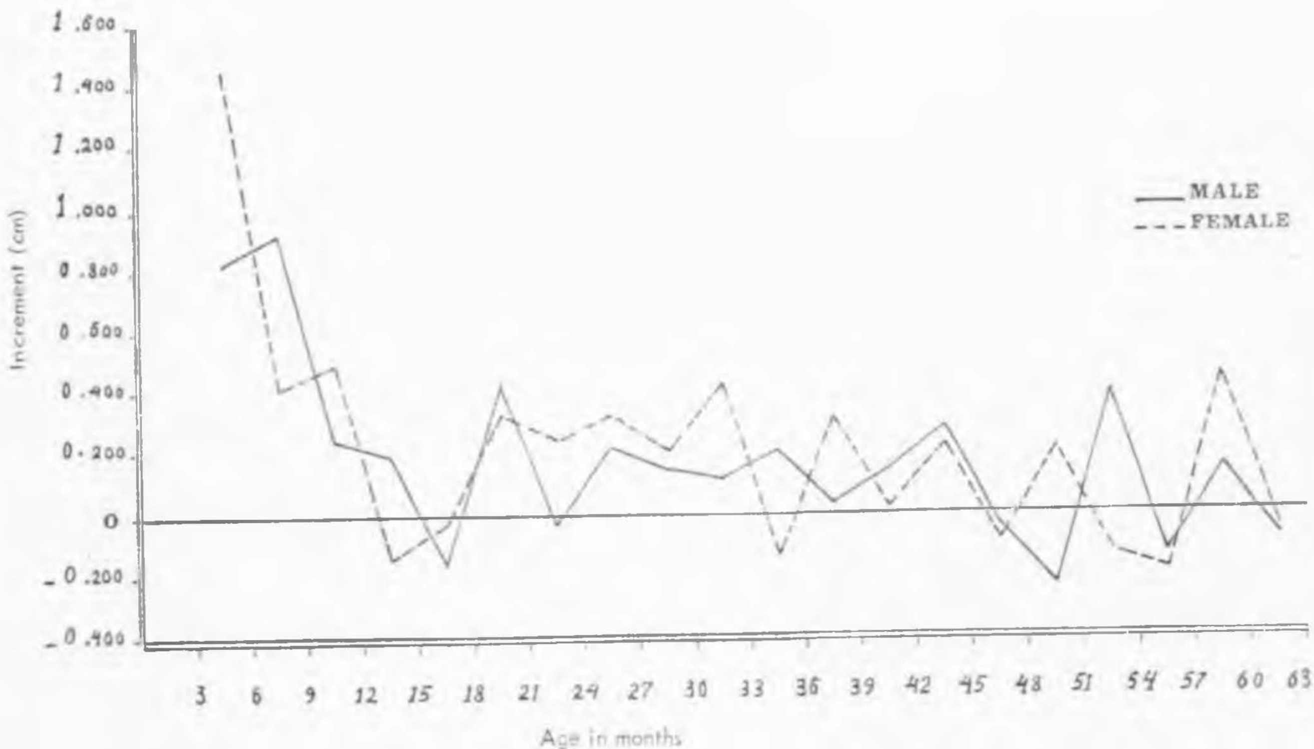


Figure 29: ARM CIRCUMFERENCE OF JORDANIAN CHILDREN (0 - 5 years) PLOTTED AGAINST THE STANDARD (Jelliffe, 1966)

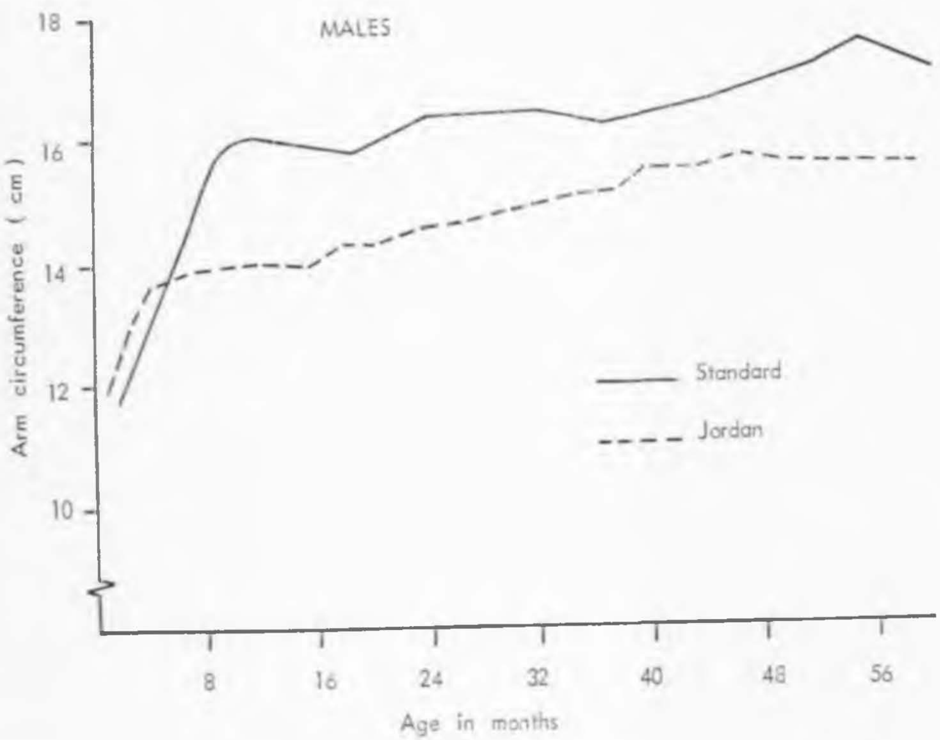


Figure 29: ARM CIRCUMFERENCE OF JORDANIAN CHILDREN (0 - 5 years)
PLOTTED AGAINST THE STANDARD (Jelliffe, 1966)

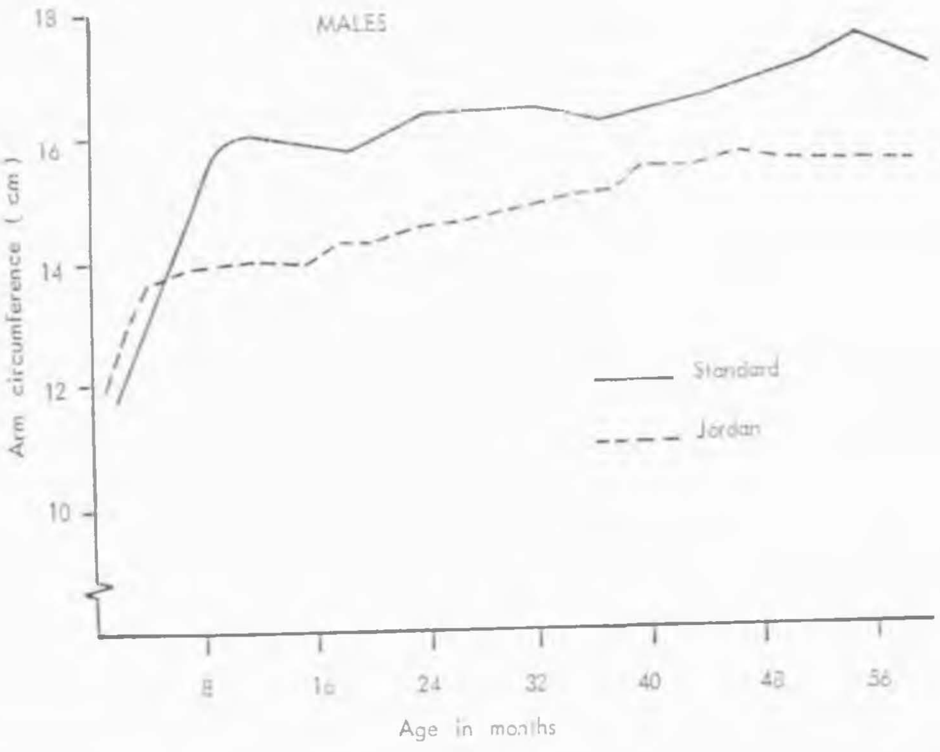


Figure 30: ARM CIRCUMFERENCE OF JORDANIAN CHILDREN (0 - 5 years) PLOTTED AGAINST THE STANDARD (Jelliffe 1966)

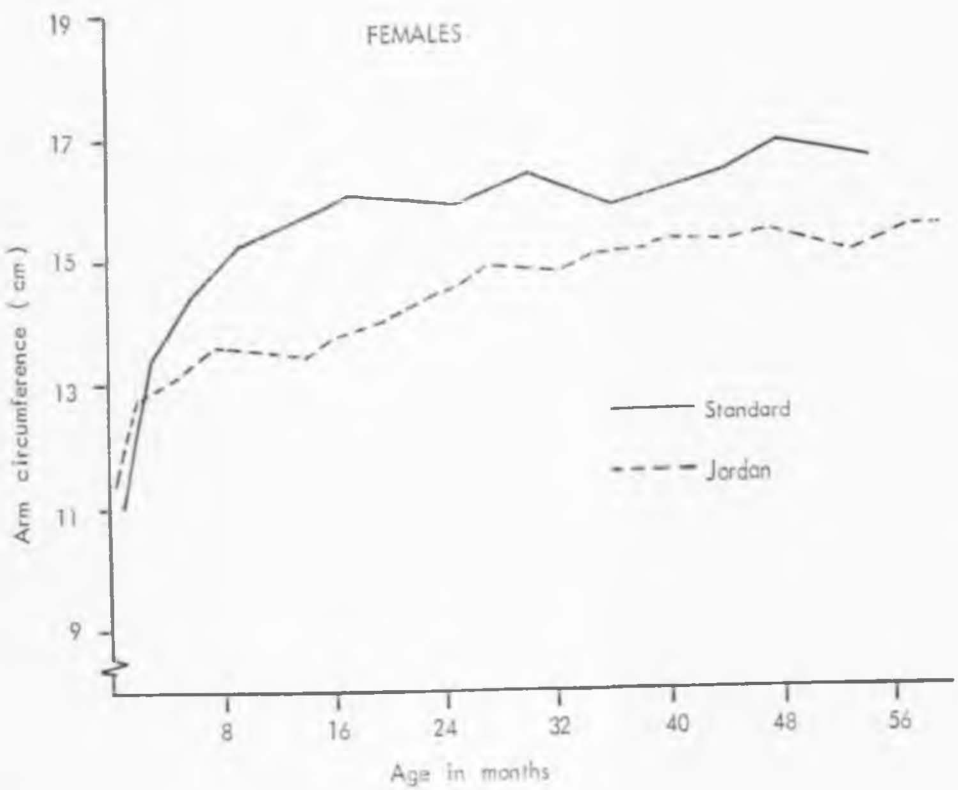
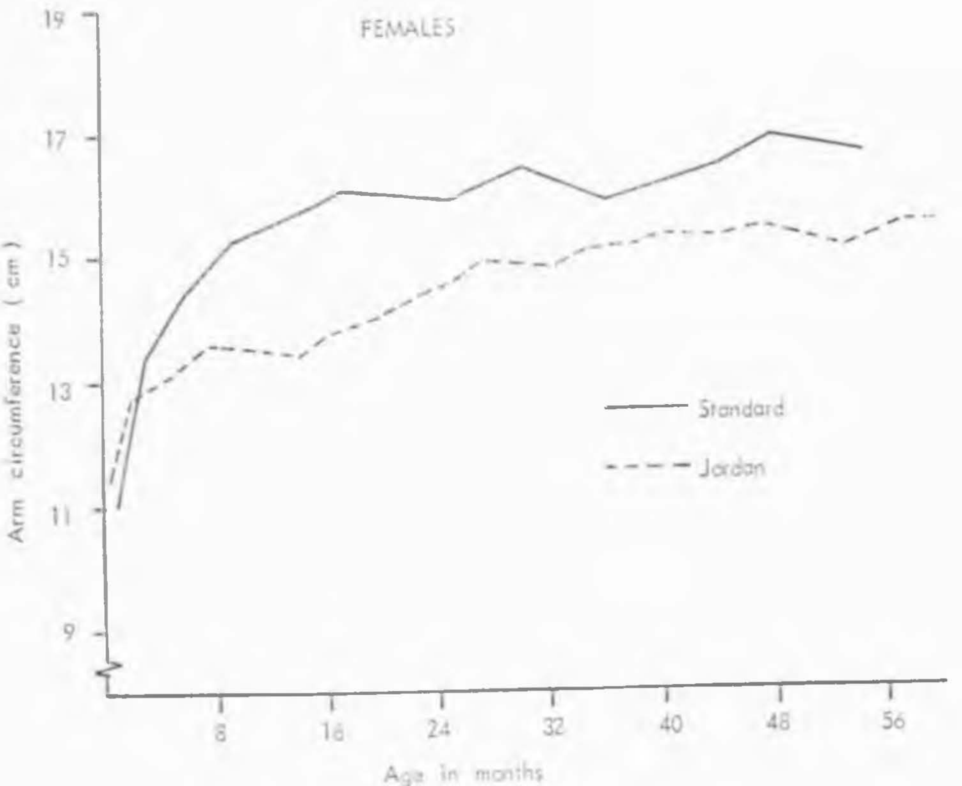


Figure 30: ARM CIRCUMFERENCE OF JORDANIAN CHILDREN (0 - 5 years) PLOTTED AGAINST THE STANDARD (Jelliffe 1966)



0-5 Years Skinfold Thickness:

1. Triceps skinfold thickness: Table 69 shows the mean triceps skinfold thickness by age and sex. Figure 31 shows the mean triceps skinfold thickness of these children plotted on Tanner's charts. The growth pattern was similar but lower than the British Standards (1970).

Figure 32 shows the median, mean and standard deviations for the triceps skinfold thickness. The mean values in general were higher than the medians.

Figure 33 shows the increments in the mean triceps skinfold thickness of males and females.

Tables 73 and 74 show the mean triceps centiles for males and females.

2. Biceps skinfold thickness: Table 70 shows the mean biceps skinfold thickness by age and sex. Figure 34 shows the mean suprailiac and biceps skinfold thickness for males and females. Figure 35 shows the increments in the mean biceps skinfold thickness of males and females.

The growth pattern of this measurement did not show a specific trend.

Tables 75 and 76 show the mean biceps centiles for males and females.

3. Subscapular skinfold thickness: Table 71 shows the mean subscapular skinfold thickness by age and sex. Figure 36 shows the mean subscapular skinfold thickness

Table 69

MEAN TRICEPS SKINFOLD THICKNESS (Mm) BY AGE AND SEX

Age (months)	Males No.	Males Mean	Males S.D.	Females No.	Females Mean	Females S.D.
0 - 3	81	6.024	1.621	85	5.447	1.692
3 - 6	84	6.846	1.887	95	7.170	2.114
6 - 9	121	7.361	2.032	86	6.840	1.697
9 - 12	107	6.947	1.638	91	6.758	1.637
12 - 15	100	6.665	1.497	94	6.498	1.546
15 - 18	97	6.524	1.771	101	6.623	1.600
18 - 21	96	7.017	1.615	71	6.719	1.547
21 - 24	94	6.895	1.383	83	6.821	1.744
24 - 27	76	6.688	1.626	115	7.153	1.827
27 - 30	93	7.093	1.739	69	7.240	1.743
30 - 33	83	7.383	1.957	92	7.566	1.894
33 - 36	92	7.158	1.744	82	7.679	1.971
36 - 39	106	7.177	1.699	95	7.384	1.785
39 - 42	77	7.161	1.699	72	7.130	1.473
42 - 45	71	6.822	1.656	73	7.304	1.903
45 - 48	96	6.709	1.550	92	7.223	1.896
48 - 51	80	6.612	1.590	85	7.130	1.712
51 - 54	90	6.919	1.842	58	6.586	1.686
54 - 57	61	6.222	1.750	40	6.357	1.414
57 - 60	65	6.301	1.347	66	6.883	1.689
60 - 63	137	6.060	1.617	157	6.632	1.572

Figure : 31

MEAN TRICEPS SKINFOLD THICKNESS OF JORDANIAN CHILDREN (0 - 5 years)
PLOTTED ON TANNER'S CHARTS

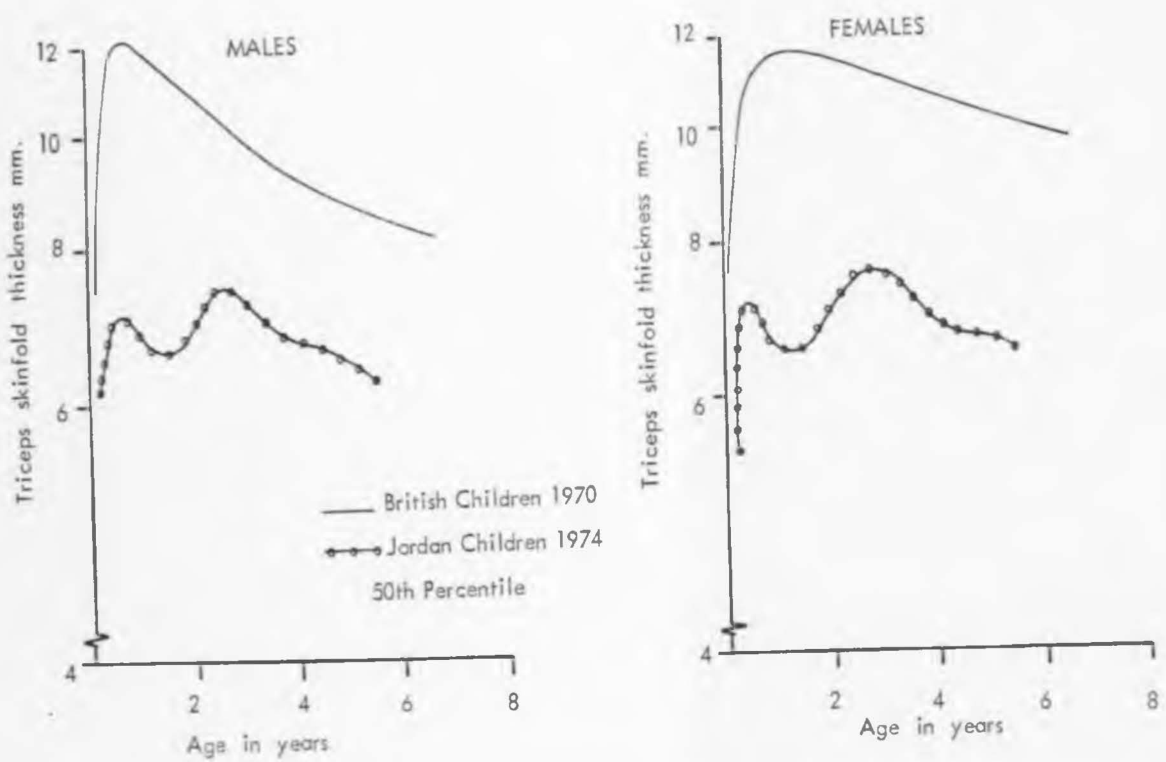


Figure : 31

MEAN TRICEPS SKINFOLD THICKNESS OF JORDANIAN CHILDREN (0 - 5 years)
PLOTTED ON TANNER'S CHARTS

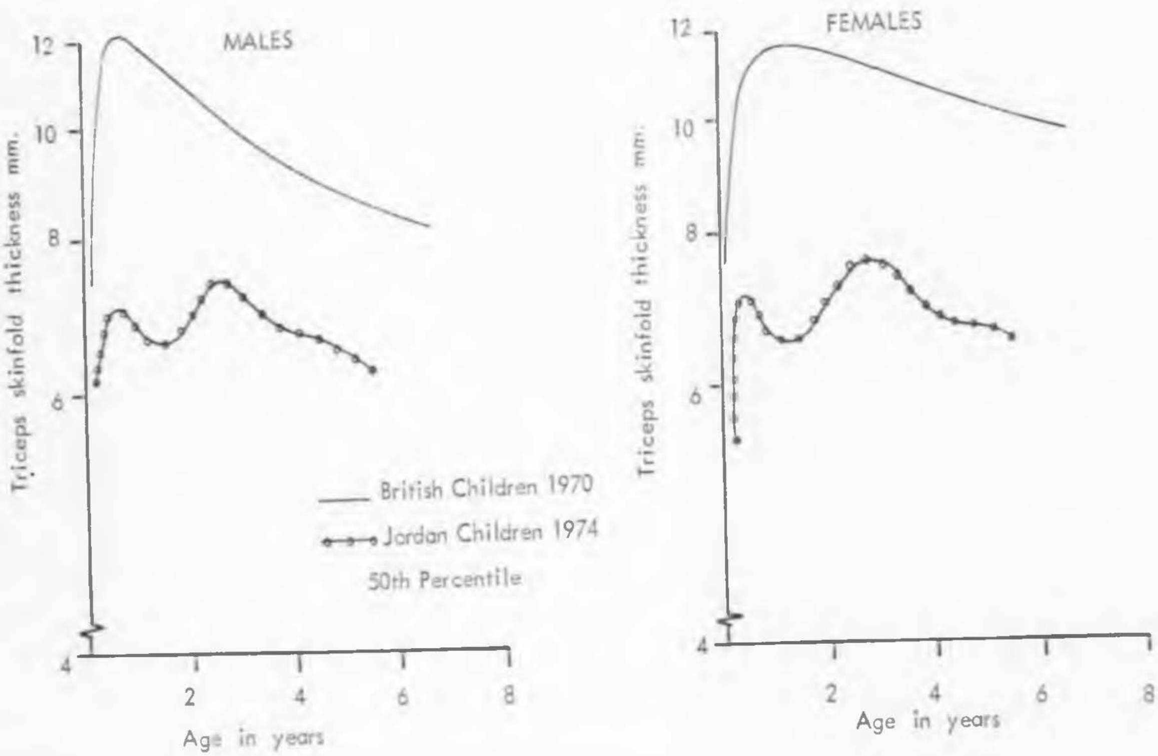


Figure : 31

MEAN TRICEPS SKINFOLD THICKNESS OF JORDANIAN CHILDREN (0 - 5 years)
PLOTTED ON TANNER'S CHARTS

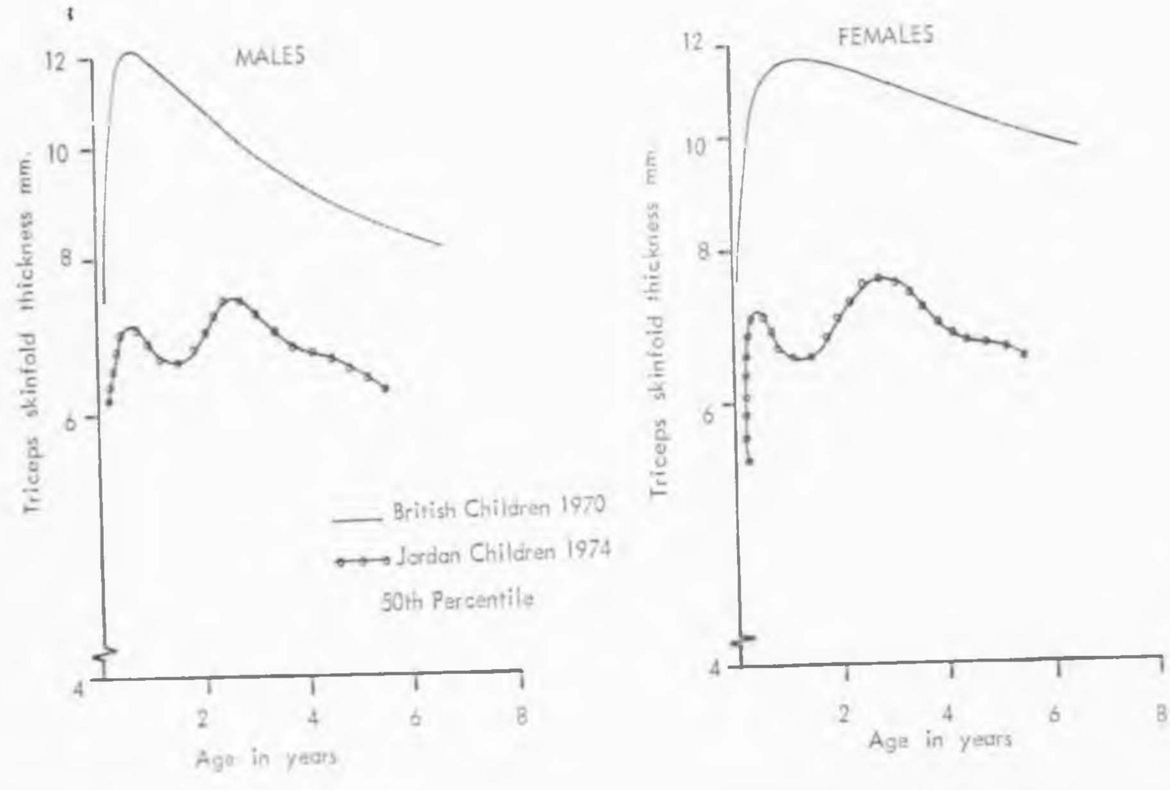


Figure : 32

MEDIAN, MEAN AND SD. OF MEAN DISTRIBUTION FOR THE TRICEPS SKINFOLD THICKNESS OF CHILDREN
(Sexes combined)

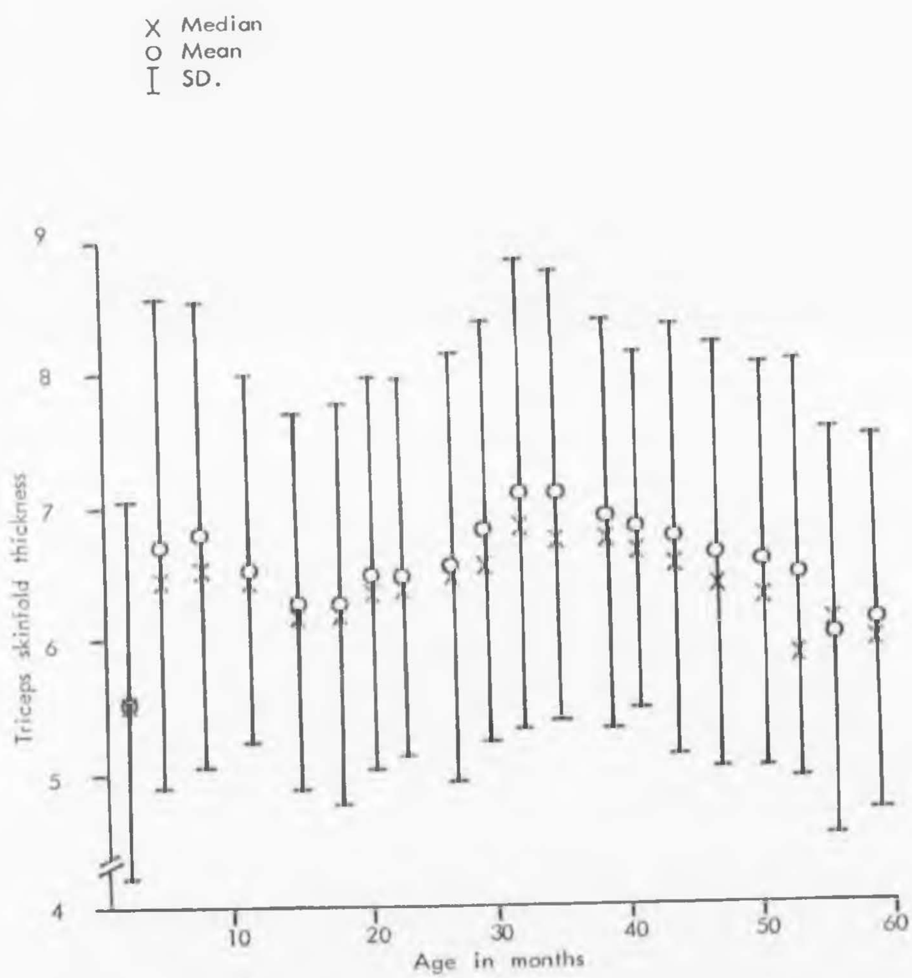


Figure : 32

MEDIAN, MEAN AND SD. OF MEAN DISTRIBUTION FOR THE TRICEPS SKINFOLD THICKNESS OF CHILDREN
(Sexes combined)

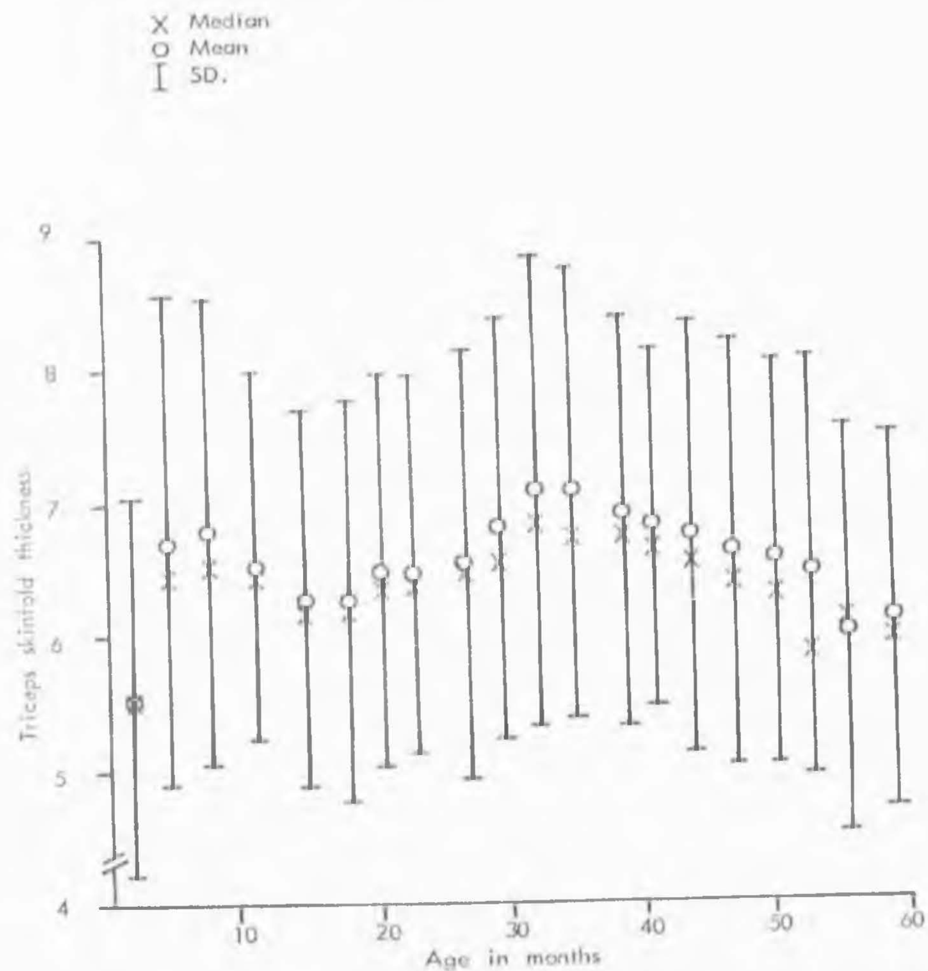


Figure 33: Increments in the mean triceps skinfold thickness, 0 - 60 months, of males and females

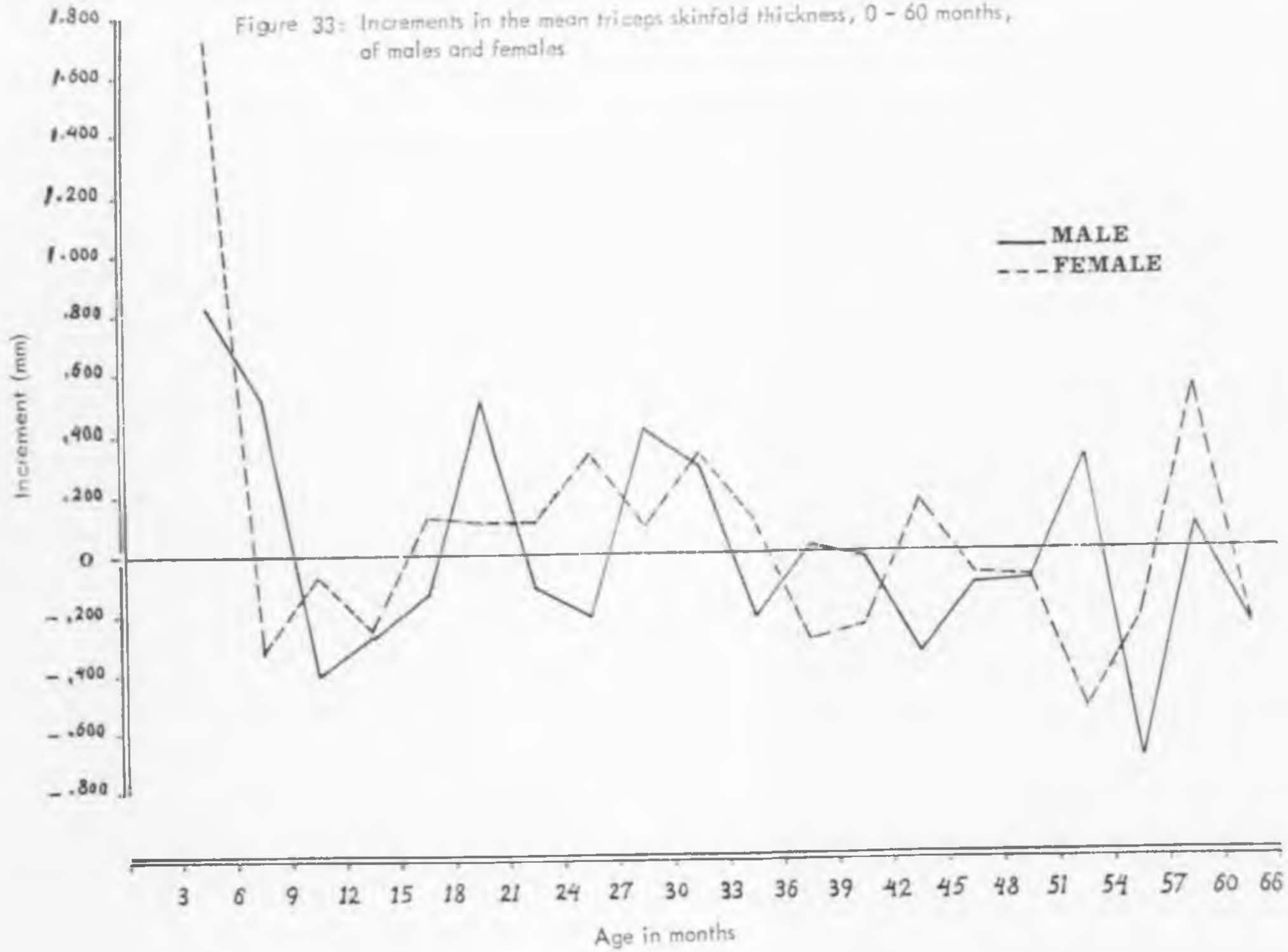


Figure 33: Increments in the mean triceps skinfold thickness, 0 – 60 months, of males and females

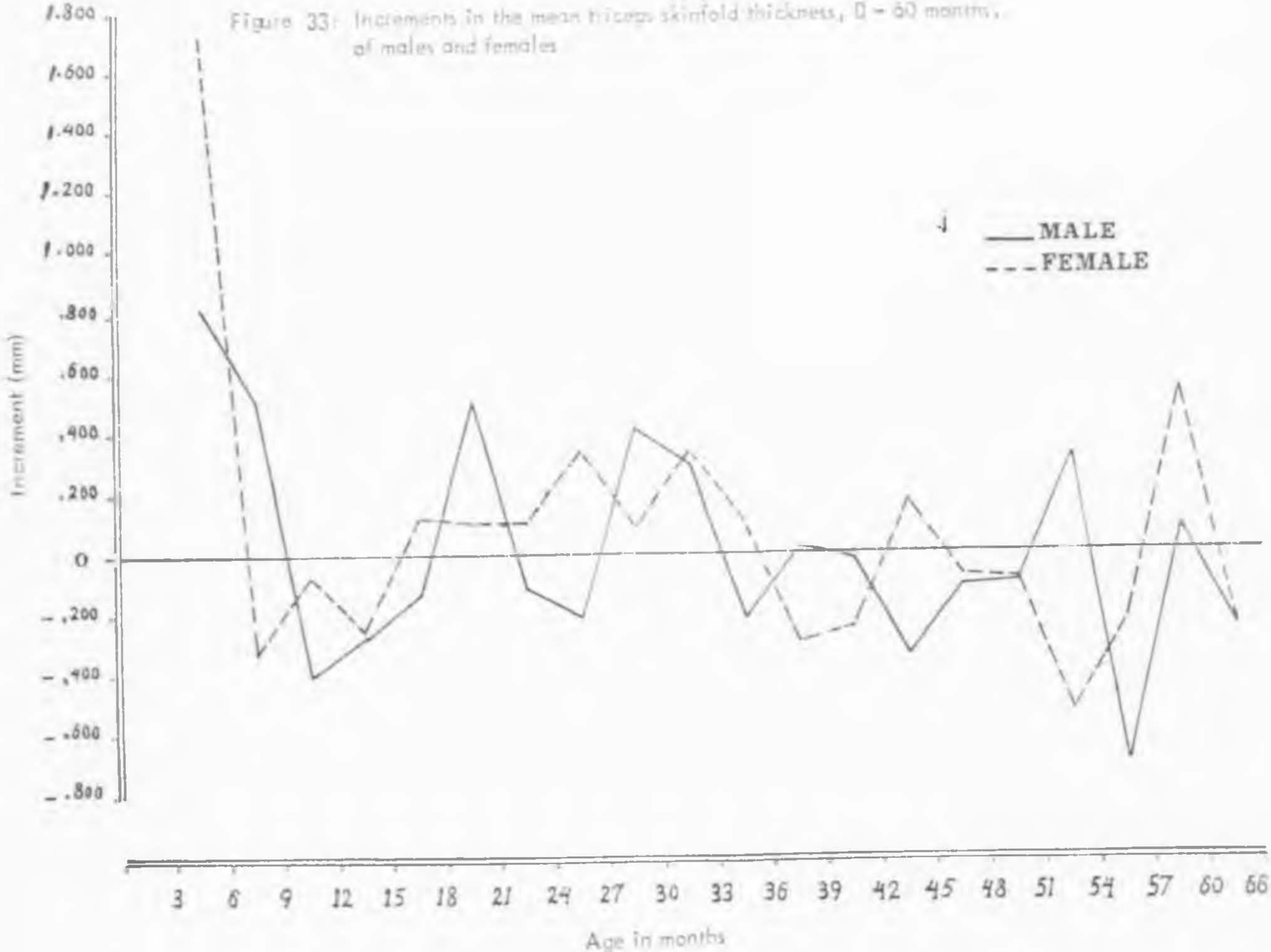


Table 70

MEAN BICEPS SKINFOLD THICKNESS (Mm) BY AGE AND SEX

	Males			Females		
Age (months)	No.	Mean	S.D.	No.	Mean	S.D.
0 - 3	81	4.330	0.970	85	3.872	1.095
3 - 6	84	4.291	1.083	95	4.473	1.164
6 - 9	121	4.621	1.360	87	4.287	1.202
9 - 12	107	4.042	0.775	91	4.425	1.253
12 - 15	100	4.171	0.922	94	4.104	0.942
15 - 18	97	4.315	1.250	101	4.049	0.907
18 - 21	96	4.285	1.093	71	4.135	1.023
21 - 24	94	4.286	1.000	83	4.224	1.191
24 - 27	76	4.165	0.885	115	4.449	1.224
27 - 30	93	4.216	1.094	69	4.450	1.097
30 - 33	83	4.253	1.041	92	4.504	1.158
33 - 36	92	4.379	0.907	82	4.629	1.454
36 - 39	106	4.329	1.307	95	4.401	1.102
39 - 42	77	4.254	1.105	72	4.116	0.977
42 - 45	71	4.050	0.847	73	4.249	1.136
45 - 48	96	3.971	1.097	92	4.327	1.187
48 - 51	80	3.891	1.028	85	4.247	1.172
51 - 54	90	3.922	0.957	58	4.082	1.146
54 - 57	61	3.859	0.986	40	3.877	0.803
57 - 60	65	3.523	0.800	66	3.974	0.863
60 - 63	137	3.658	0.873	157	3.917	0.953

Figure 34 : Mean suprailiac and biceps skinfold thickness for males and females from birth to five years

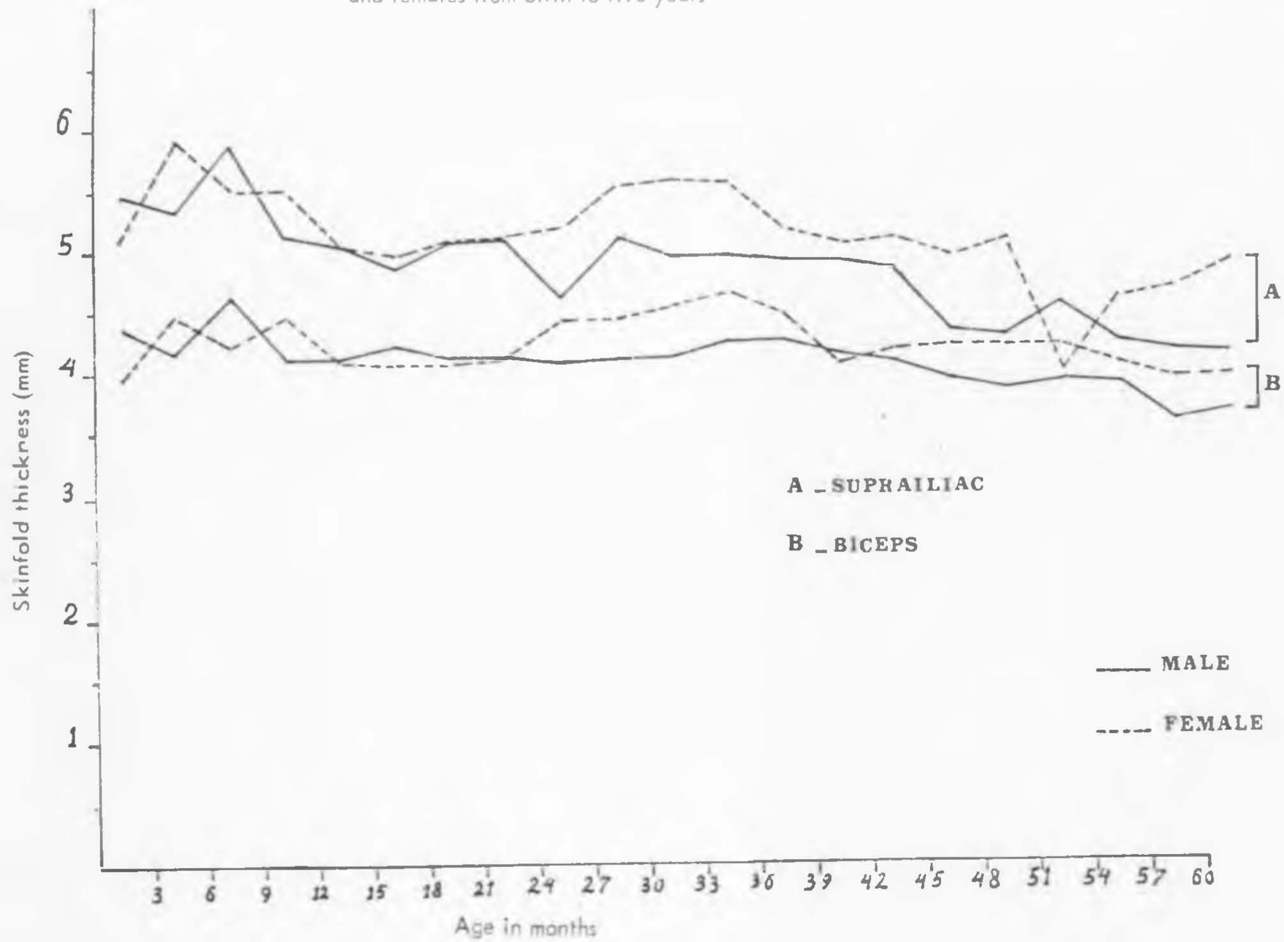


Fig. [illegible] Mean suprailiac and biceps skinfold thickness for males
and females from birth to five years

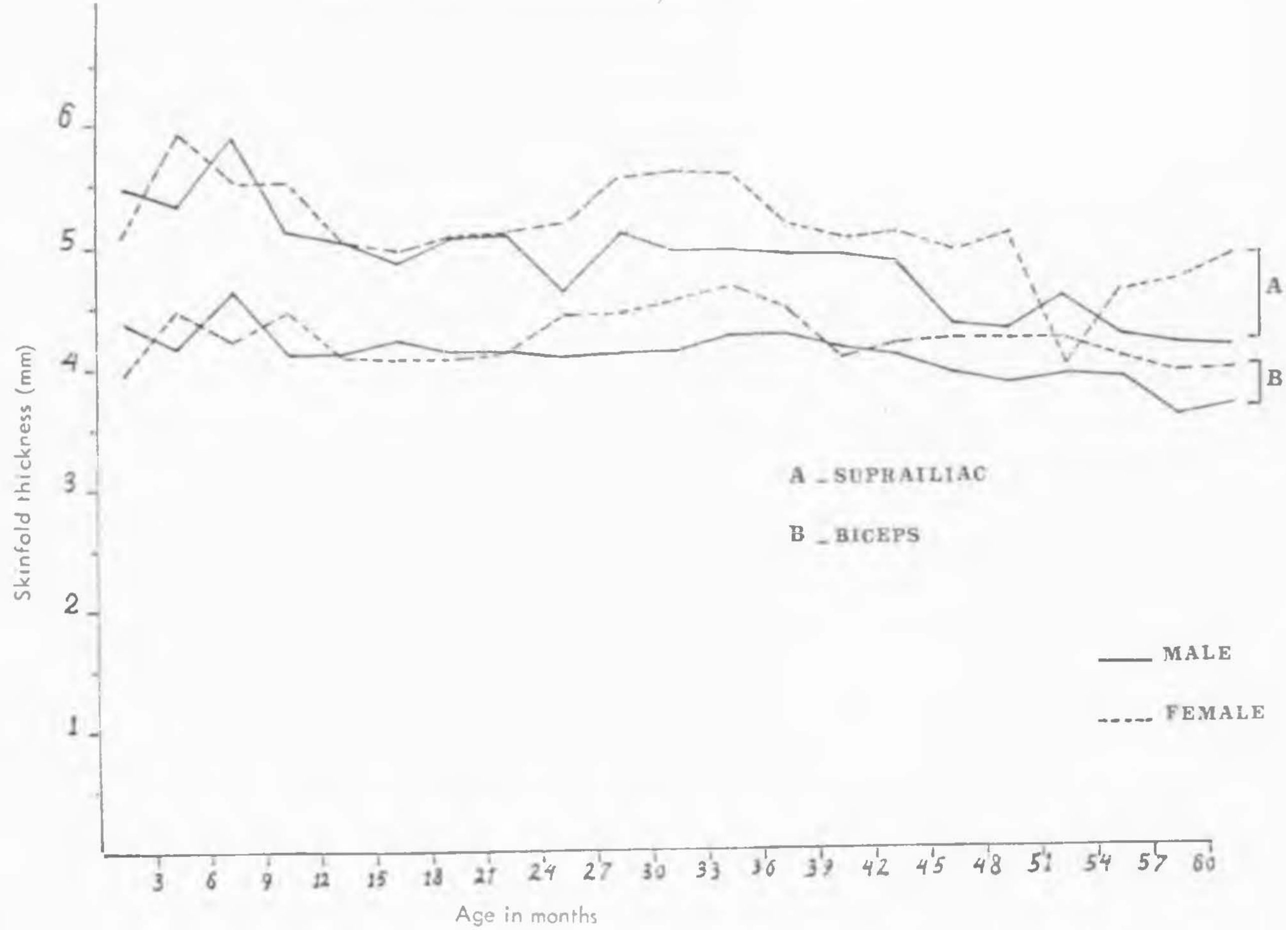


Figure 35 : Increments in the mean biceps skinfold thickness, 0 - 60 months, of males and females

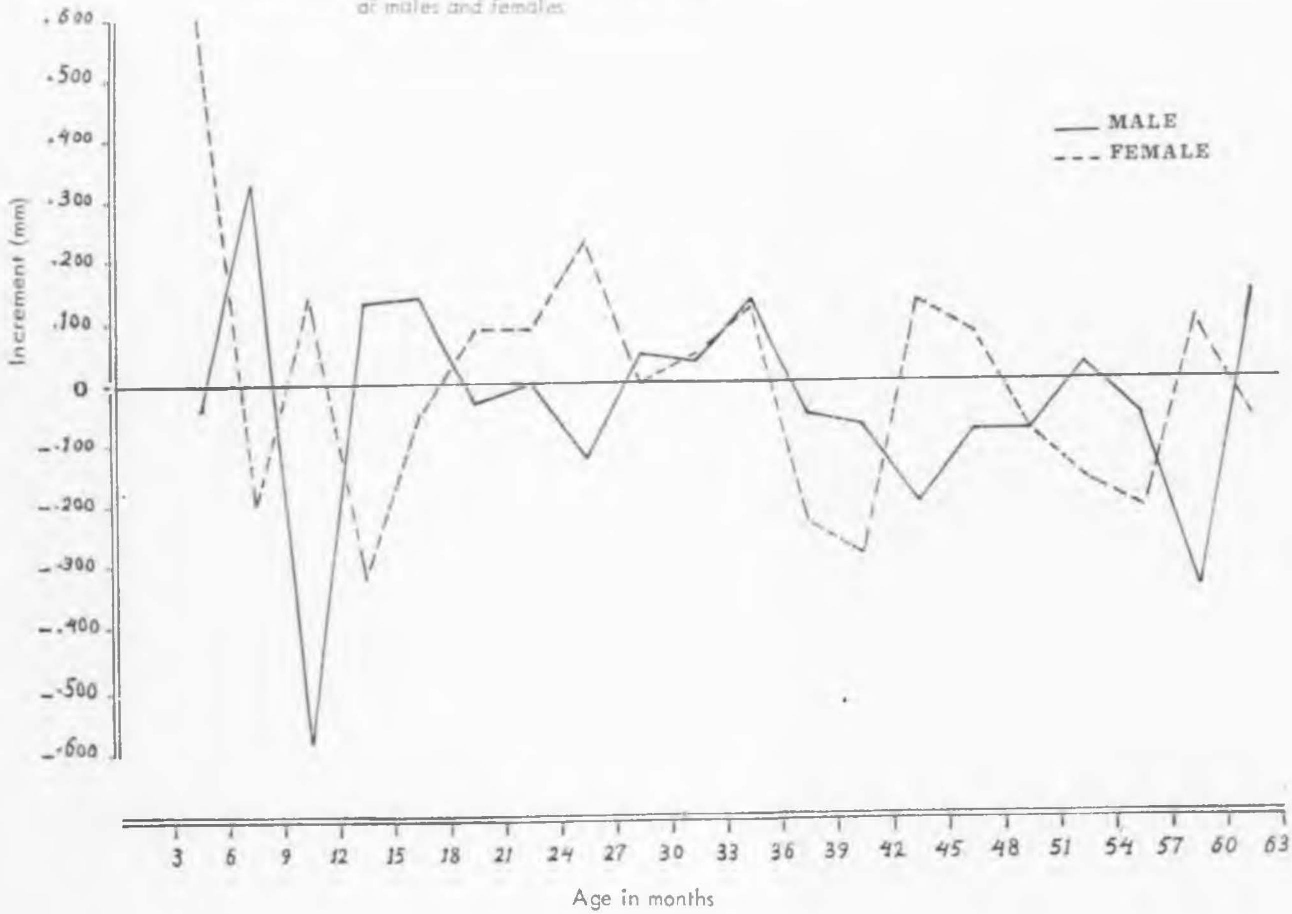


Figure 6[illegible] : Increments in the mean [illegible] thickness, 0 – 60 months, of males and females

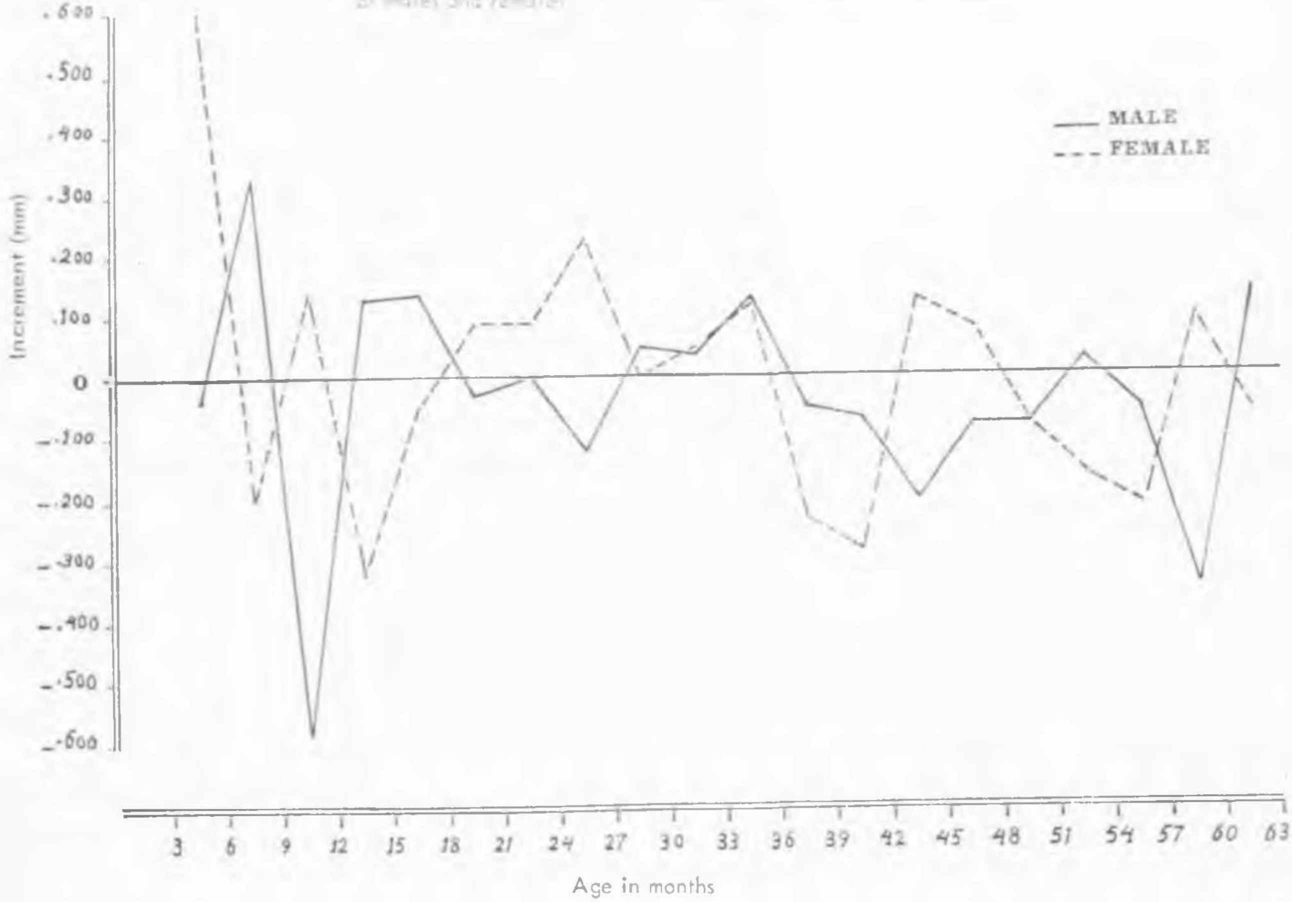


Table 71

MEAN SUBSCAPULAR SKINFOLD THICKNESS (Mm) BY AGE AND SEX

	Males			Females		
Age (months)	No.	Mean	S.D.	No.	Mean	S.D.
0 - 3	81	6.182	2.017	85	6.378	2.662
3 - 6	84	7.011	2.621	95	7.772	2.808
6 - 9	120	7.029	2.346	87	6.633	1.953
9 - 12	107	6.457	2.198	91	6.530	2.279
12 - 15	100	5.800	1.805	94	6.037	2.035
15 - 18	97	5.420	1.805	101	5.814	2.115
18 - 21	96	5.818	2.192	71	5.715	1.791
21 - 24	94	5.535	1.736	83	5.651	1.809
24 - 27	76	5.823	2.242	115	6.242	2.084
27 - 30	93	5.427	1.773	69	6.628	2.370
30 - 33	83	5.483	2.122	92	6.278	2.329
33 - 36	92	5.534	1.747	82	6.593	2.316
36 - 39	106	5.600	2.186	95	6.470	2.134
39 - 42	77	5.602	1.856	72	5.873	2.134
42 - 45	71	5.174	1.630	73	5.964	1.873
45 - 48	96	5.110	1.982	92	5.834	1.913
48 - 51	80	4.663	1.370	85	6.195	2.331
51 - 54	90	4.732	1.455	58	5.793	2.192
54 - 57	61	4.506	1.362	40	5.522	2.235
57 - 60	65	4.564	1.182	66	5.628	1.912
60 - 63	137	4.433	1.328	157	5.411	1.895

Table 72

MEAN SUPRAILIAC SKINFOLD THICKNESS (Mm) BY AGE AND SEX

Age (months)	Males			Females		
	No.	Mean	S.D.	No.	Mean	S.D.
0 - 3	81	5.470	1.489	85	5.089	1.541
3 - 6	84	5.363	1.426	95	5.804	1.452
6 - 9	120	5.864	1.559	87	5.541	1.120
9 - 12	107	5.287	1.201	91	5.571	1.248
12 - 15	100	5.099	1.225	94	5.011	1.109
15 - 18	97	4.802	1.136	101	4.915	1.032
18 - 21	96	5.135	1.149	71	5.211	1.168
21 - 24	94	5.162	1.044	83	5.104	1.348
24 - 27	76	4.761	0.973	115	5.3999	1.276
27 - 30	93	5.035	1.300	69	5.524	1.721
30 - 33	83	4.981	1.418	92	5.626	1.490
33 - 36	92	5.071	1.043	82	5.578	1.484
36 - 39	106	4.965	1.455	95	5.398	1.300
39 - 42	77	4.919	1.310	72	5.131	1.213
42 - 45	71	4.807	1.248	73	5.379	1.383
45 - 48	96	4.482	1.107	92	4.977	1.305
48 - 51	80	4.404	1.088	85	5.047	1.402
51 - 54	90	4.558	1.222	58	4.849	1.421
54 - 57	61	4.293	1.089	40	4.644	1.307
57 - 60	65	4.106	0.744	66	4.727	1.106
60 - 63	137	4.265	0.901	157	4.800	1.415

Table 73

MEAN TRICEPS SKINFOLD THICKNESS (MM) PERCENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					MALES			
0 - 3	81	3.377	4.229	5.180	5.901	6.667	7.396	10.771
3 - 6	84	3.513	4.444	5.676	6.848	8.302	9.597	10.341
6 - 9	121	3.736	5.161	5.935	7.123	8.377	10.138	12.481
9 - 12	107	4.569	5.080	5.751	6.914	7.579	9.304	10.381
12 - 15	100	4.402	4.822	5.635	6.544	7.404	8.609	10.416
15 - 18	97	4.432	4.658	5.198	6.148	7.298	9.241	10.227
18 - 21	96	4.378	5.158	5.848	6.931	8.062	9.417	10.72[illegible]
21 - 24	94	4.586	5.147	5.831	6.891	7.792	8.998	9.845
24 - 27	76	4.421	4.776	5.676	6.536	7.704	8.895	9.730
27 - 30	93	4.538	5.026	5.852	6.938	8.154	9.549	11.077
30 - 33	83	4.480	5.156	5.947	7.148	8.558	9.749	11.935
33 - 36	92	4.640	5.168	5.854	6.992	8.203	9.884	11.38[illegible]
36 - 39	106	4.623	5.182	5.838	7.062	8.302	9.717	10.660
39 - 42	77	4.683	5.235	5.857	6.994	8.340	9.341	10.621
42 - 45	71	4.541	5.045	5.472	6.654	8.020	9.184	10.375
45 - 48	96	4.461	4.909	5.601	6.362	7.301	9.133	10.180
48 - 51	80	4.424	4.729	5.423	6.302	7.553	9.214	10.237
51 - 54	90	4.324	4.853	5.701	6.578	7.932	8.869	10.009
54 - 57	61	3.975	4.517	5.022	5.866	6.919	8.884	10.165
57 - 60	65	4.399	4.609	5.130	6.061	7.116	8.232	9.529
60 - 63	137	3.877	4.443	4.957	5.788	6.934	8.320	9.640

MEAN TRICEPS SKINFOLD THICKNESS (MM) PERCENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					FEMALES			
0 - 3	85	2.519	3.454	4.410	5.454	6.427	7.291	9.899
3 - 6	95	4.085	4.673	5.639	6.929	8.529	10.105	11.717
6 - 9	86	4.454	4.970	5.712	6.529	7.465	9.117	10.840
9 - 12	91	4.355	5.005	5.552	6.554	8.017	8.994	10.591
12 - 15	94	4.080	4.696	5.409	6.144	7.266	8.482	9.937
15 - 18	101	3.961	4.814	5.686	6.502	7.339	8.537	10.203
18 - 21	71	4.236	5.011	5.698	6.436	7.659	8.895	9.775
21 - 24	83	4.484	4.800	5.634	6.652	7.619	9.649	11.167
24 - 27	115	4.456	4.758	5.643	7.112	8.343	9.745	10.879
27 - 30	69	4.435	5.590	5.986	6.960	8.215	10.177	10.846
30 - 33	92	4.581	5.269	6.073	7.214	8.609	10.150	12.373
33 - 36	82	4.626	5.278	6.369	7.221	9.254	10.313	11.953
36 - 39	95	4.508	5.255	6.005	7.242	8.527	9.745	11.119
39 - 42	72	4.665	5.269	6.083	6.951	7.918	9.477	10.577
42 - 45	73	4.548	5.161	5.998	7.038	8.239	10.121	11.515
45 - 48	92	4.581	5.192	5.885	6.872	8.175	10.088	11.773
48 - 51	85	4.319	5.116	5.852	7.008	8.312	9.505	10.324
51 - 54	58	4.274	4.609	5.232	6.204	7.585	8.974	9.69[illegible]
54 - 57	40	4.175	4.707	5.486	6.142	7.103	8.614	9.709
57 - 60	66	4.605	5.144	5.654	6.409	8.032	8.869	11.041
60 - 63	157	4.458	4.824	5.477	6.225	7.395	8.801	10.133

MEAN BICEPS SKINFOLD THICKNESS (MM) PERCENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					MALES			
0 - 3	81	2.673	3.151	3.661	4.153	4.956	5.590	6.500
3 - 6	84	2.445	3.056	3.524	4.168	4.949	5.576	6.95[illegible]
6 - 9	121	2.694	3.147	3.524	4.273	5.587	6.469	7.904
9 - 12	107	2.547	3.115	3.554	3.966	4.481	5.140	5.572
12 - 15	100	2.697	3.108	3.448	4.033	4.758	5.468	6.476
15 - 18	97	2.604	2.899	3.385	4.019	5.001	5.949	7.050
18 - 21	96	2.568	2.917	3.487	4.037	4.961	5.852	6.709
21 - 24	94	2.768	3.177	3.633	4.015	4.564	5.609	7.06[illegible]
24 - 27	76	2.630	2.881	3.458	4.199	4.733	5.356	5.58[illegible]
27 - 30	93	2.606	2.914	3.385	4.016	4.826	5.367	6.971
30 - 33	83	2.551	2.886	3.404	4.188	5.021	5.628	6.565
33 - 36	92	2.885	3.313	3.741	4.245	4.926	5.528	6.730
36 - 39	106	2.578	2.928	3.392	4.103	5.073	5.894	7.426
39 - 42	77	2.695	3.065	3.466	3.969	4.717	5.700	7.132
42 - 45	71	2.581	2.839	3.432	3.985	4.517	5.116	5.631
45 - 48	96	2.253	2.678	3.205	3.821	4.419	5.592	6.882
48 - 51	80	2.582	2.825	3.214	3.725	4.341	5.346	6.058
51 - 54	90	2.476	2.744	3.232	3.831	4.368	5.037	5.821
54 - 57	61	2.195	2.586	3.136	3.808	4.357	5.243	6.274
57 - 60	65	2.260	2.593	2.875	3.405	3.969	4.671	5.40[illegible]
60 - 63	137	2.240	2.597	2.931	3.601	4.188	4.844	5.635

MEAN BICEPS SKINFOLD THICKNESS (MM) PERCENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					F E M A L E S			
0 - 3	85	2.225	2.630	3.118	3.633	4.381	5.514	6.419
3 - 6	95	2.618	2.964	3.583	4.292	5.138	6.231	7.09[illegible]
6 - 9	87	2.461	2.852	3.503	4.099	4.979	5.609	6.908
9 - 12	91	2.760	3.149	3.602	4.149	5.067	5.977	7.36[illegible]
12 - 15	94	2.570	2.950	3.506	3.984	4.587	5.292	6.219
15 - 18	101	2.571	2.905	3.376	3.904	4.536	5.463	6.058
18 - 21	71	2.283	2.793	3.490	3.990	4.626	5.548	6.638
21 - 24	83	2.606	2.944	3.391	3.911	5.067	5.536	6.56[illegible]
24 - 27	115	2.563	3.106	3.554	4.250	5.165	5.903	7.511
27 - 30	69	2.540	3.152	3.682	4.292	5.205	6.179	6.849
30 - 33	92	2.487	3.112	3.717	4.304	5.241	5.973	7.015
33 - 36	82	2.546	2.845	3.444	4.314	5.687	6.768	7.827
36 - 39	95	2.578	3.010	3.618	4.278	5.031	5.801	6.57[illegible]
39 - 42	72	2.383	2.880	3.510	3.982	4.603	5.366	6.131
42 - 45	73	2.535	2.867	3.399	4.143	4.595	6.116	6.903
45 - 48	92	2.654	3.072	3.431	4.110	4.949	5.832	7.79[illegible]
48 - 51	85	2.338	2.815	3.479	4.068	4.849	5.697	6.549
51 - 54	58	2.232	2.712	3.360	3.898	4.484	5.510	6.321
54 - 57	40	2.325	2.786	3.340	3.893	4.394	4.955	5.600
57 - 60	66	2.637	2.904	3.270	3.821	4.461	5.308	5.998
60 - 63	157	2.247	2.655	3.185	3.841	4.434	5.033	5.944

Figure : 36

MEAN SUBSCAPULAR SKINFOLD THICKNESS OF JORDANIAN CHILDREN (0 - 5 years)
PLOTTED ON TANNER's CHART (1970)

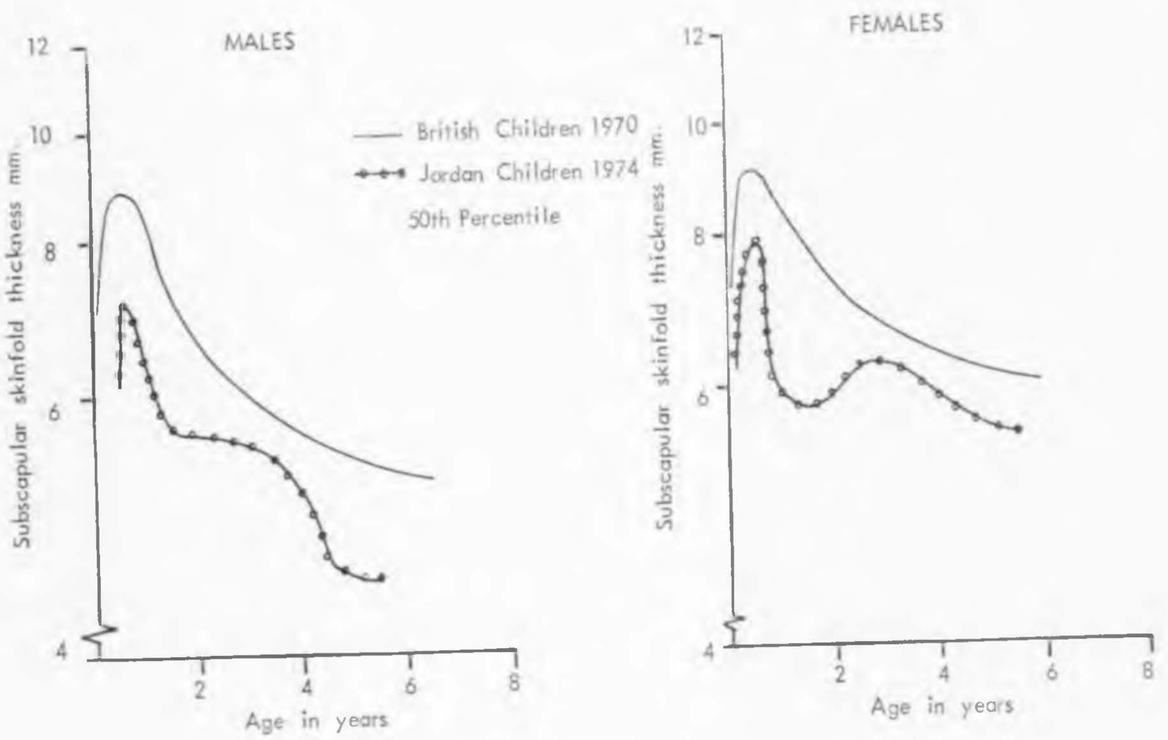


Figure : 36

MEAN SUBSCAPULAR SKINFOLD THICKNESS OF JORDANIAN CHILDREN (0 - 5 years)
PLOTTED ON TANNER's CHART (1970)

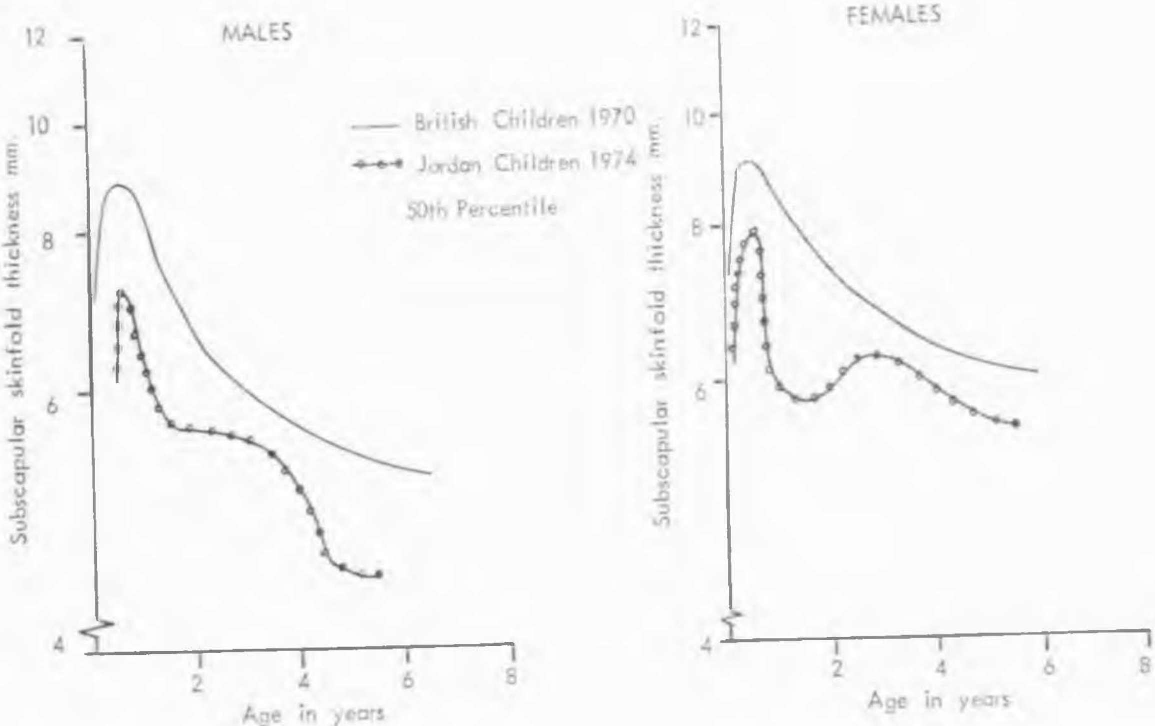
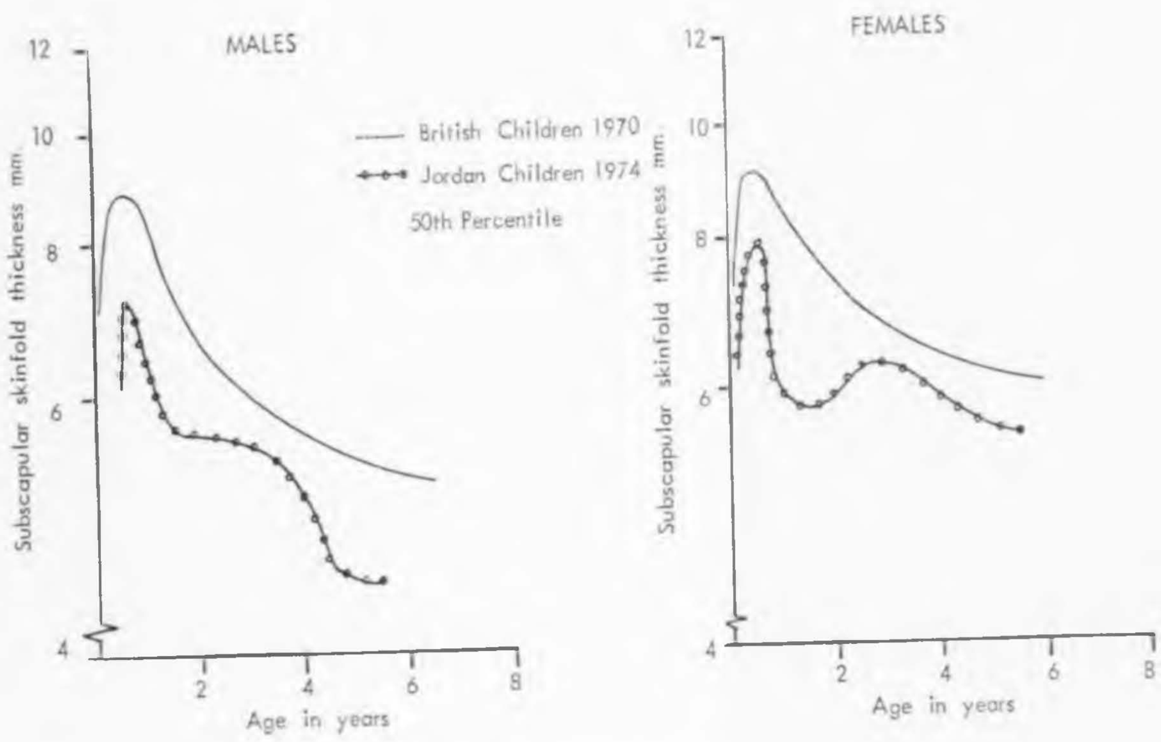


Figure : 36

MEAN SUBSCAPULAR SKINFOLD THICKNESS OF JORDANIAN CHILDREN (0 - 5 years)
PLOTTED ON TANNER's CHART (1970)

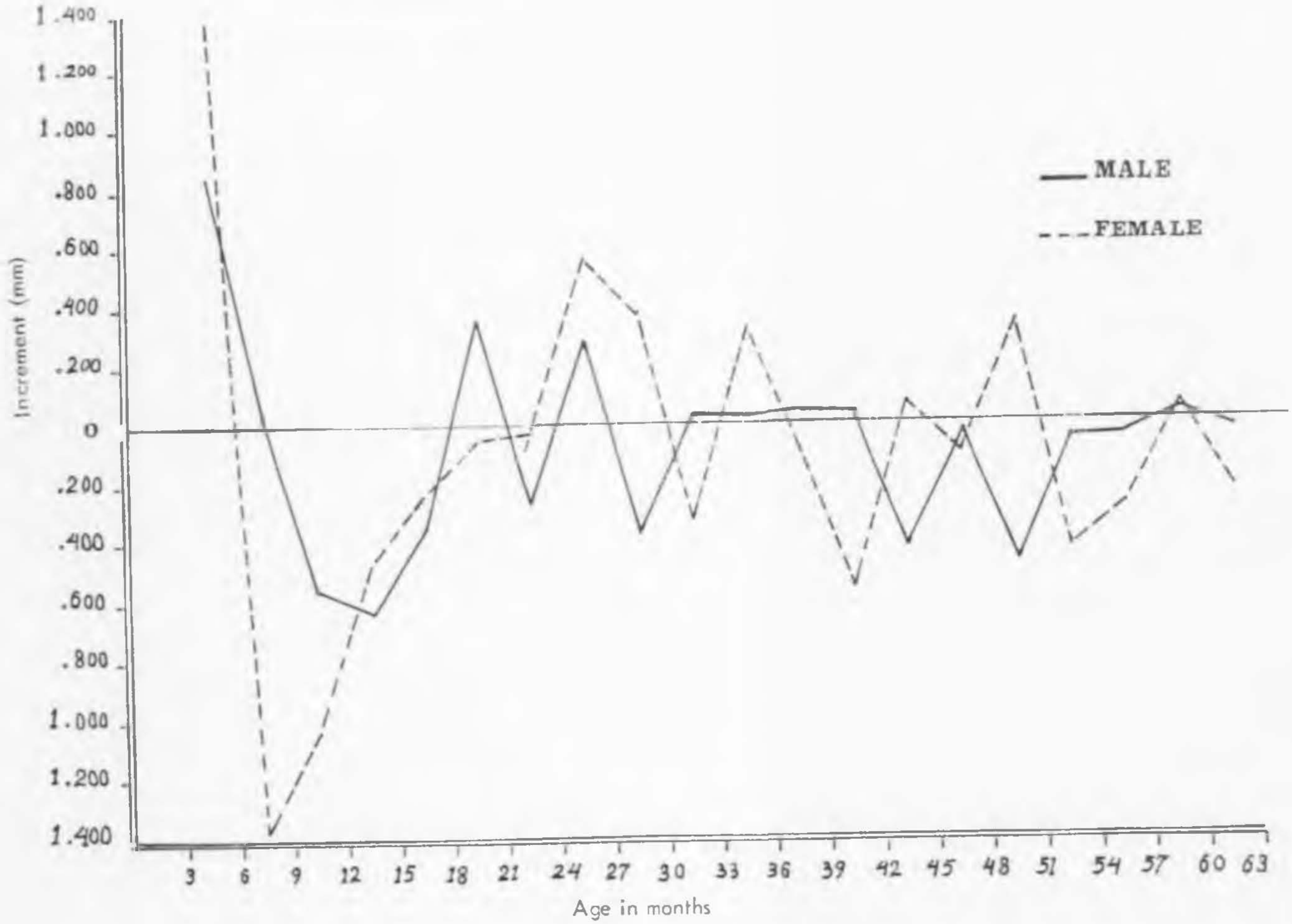


plotted on Tanner's charts. The growth pattern here was similar but lower than the British Standards (1970). Figure 37 shows increments in the mean subscapular skinfold thickness for males and females. Tables 77 and 78 show the mean subscapular centiles.

4. Suprailiac skinfold thickness: Table 72 shows the mean suprailiac skinfold thickness by age and sex. Figure 34 shows mean suprailiac and biceps skinfold thickness for males and females.

Tables 79 and 80 show the mean suprailiac centiles.

Figure 37 : Increments in the mean subscapular skinfold thickness 0 – 60 months of males and females



[illegible] in the mean subscapula-skinfold thickness 0 – 60 months of males and females

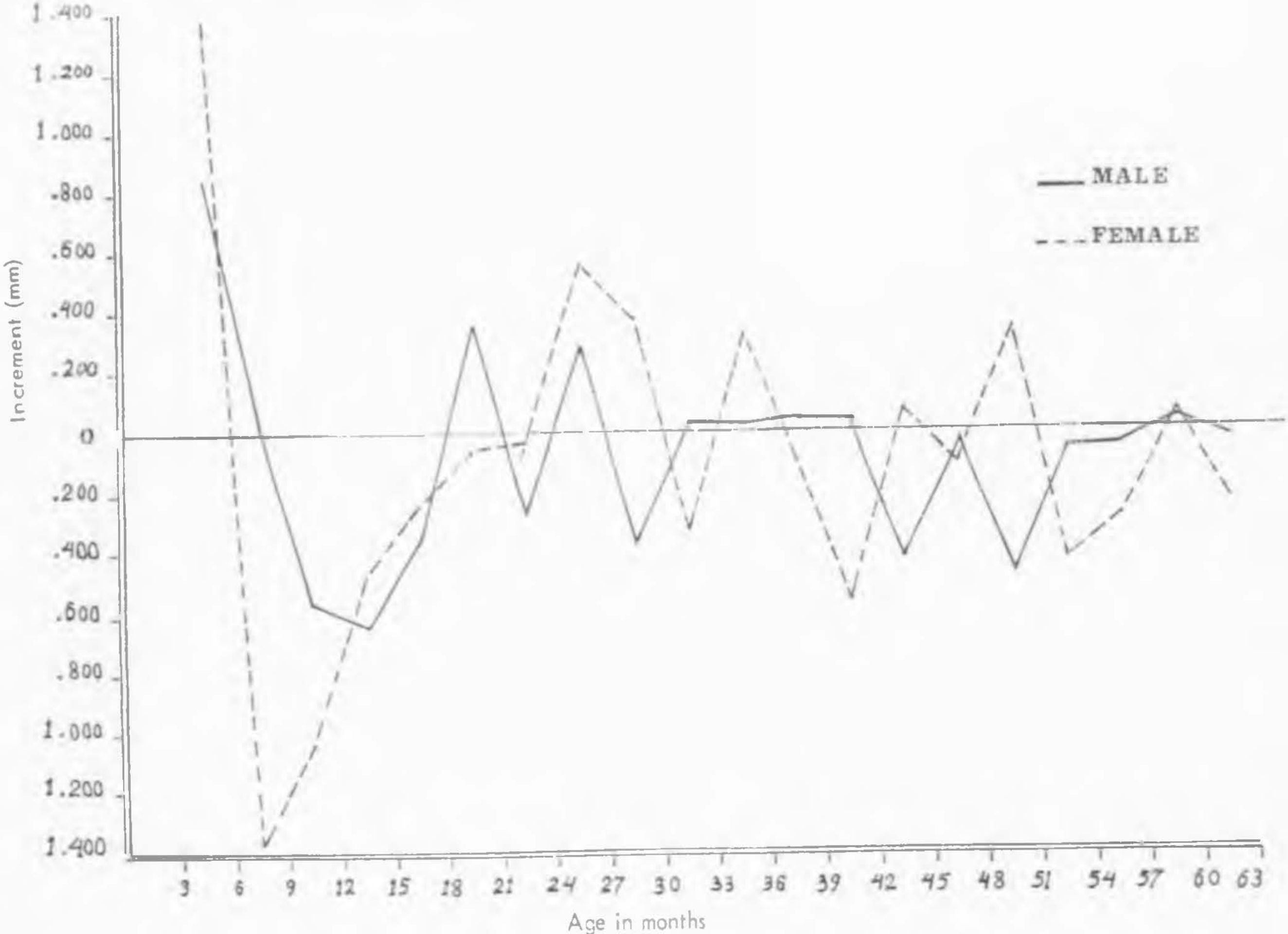


Table 77

MEAN SUBSCAPULAR SKINFOLD THICKNESS (MM) PERCENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					MALES			
0 - 3	81	3.348	3.937	4.783	5.716	7.639	8.989	9.980
3 - 6	84	3.268	3.973	5.153	6.653	8.809	10.329	12.165
6 - 9	120	3.964	4.515	5.078	6.834	8.302	10.304	12.334
9 - 12	107	3.471	4.116	4.772	6.042	7.331	9.961	11.503
12 - 15	100	3.507	4.016	4.613	5.526	6.704	8.307	9.229
15 - 18	97	3.263	3.716	4.132	4.908	6.122	8.069	10.126
18 - 21	96	3.279	3.832	4.487	5.241	6.409	9.489	10.316
21 - 24	94	3.287	3.872	4.473	4.959	6.282	8.194	9.937
24 - 27	76	3.239	3.832	4.401	5.261	6.514	9.373	10.861
27 - 30	93	3.168	3.546	4.307	4.962	6.619	8.089	7.355
30 - 33	83	2.654	3.226	4.061	5.047	6.597	8.149	9.967
33 - 36	92	3.321	3.921	4.428	5.123	6.204	7.387	9.973
36 - 39	106	2.867	3.432	4.120	4.971	6.625	9.489	10.960
39 - 42	77	3.376	3.781	4.284	5.116	6.190	8.881	10.147
42 - 45	71	3.258	3.507	4.039	4.852	5.953	7.392	9.173
45 - 48	96	2.679	3.227	3.827	4.502	6.082	8.289	9.830
48 - 51	80	2.654	3.239	3.689	4.514	5.469	6.657	7.264
51 - 54	90	2.712	3.352	3.960	4.615	5.227	6.053	7.804
54 - 57	61	2.375	2.914	3.739	4.420	4.992	6.193	8.131
57 - 60	65	3.199	3.473	3.926	4.417	4.930	5.954	7.219
60 - 63	137	2.649	3.060	3.570	4.270	4.995	6.023	7.293

Table 78

MEAN SUBSCAPULAR SKINFOLD THICKNESS IN PERCENTILES BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					F E M A L E S			
0 - 3	85	2.920	3.654	4.321	5.754	7.559	10.054	13.547
3 - 6	95	3.779	4.569	5.752	7.257	9.402	11.905	14.113
6 - 9	87	3.865	4.434	5.095	6.391	8.179	9.552	10.687
9 - 12	91	3.467	4.076	4.777	5.966	8.194	10.069	10.591
12 - 15	94	3.360	3.887	4.558	5.778	7.275	8.576	10.537
15 - 18	101	2.461	3.555	4.494	5.411	6.919	8.593	10.705
18 - 21	71	2.835	3.514	4.385	5.727	6.997	8.189	9.751
21 - 24	83	3.354	3.847	4.287	4.984	6.822	8.262	10.033
24 - 27	115	3.462	4.104	4.706	5.755	7.251	9.054	10.759
27 - 30	69	3.811	4.295	4.798	5.903	8.269	10.144	12.187
30 - 33	92	3.143	3.939	4.507	5.603	8.004	9.901	11.773
33 - 36	82	2.826	3.687	4.854	6.409	8.116	9.754	11.953
36 - 39	95	3.779	4.192	4.741	6.077	7.859	9.282	11.839
39 - 42	72	3.421	3.893	4.527	5.261	6.804	8.569	11.566
42 - 45	73	2.972	4.023	4.664	5.717	7.084	8.549	10.057
45 - 48	92	3.297	3.889	4.433	5.336	7.054	8.221	10.573
48 - 51	85	3.337	3.829	4.538	5.725	7.255	9.985	11.749
51 - 54	58	3.073	3.585	4.236	5.432	7.018	9.849	11.092
54 - 57	40	2.974	3.507	4.147	4.869	6.214	9.229	12.109
57 - 60	66	3.203	3.757	4.446	4.941	7.018	8.173	10.120
60 - 63	157	2.859	3.437	4.225	5.133	6.174	7.338	9.677

Table 79

MEAN SUPRAILIAC SKINFOLD THICKNESS (MM) [illegible] BY AGE AND SEX

CHILD GROWTH SURVEY - AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					MALES			
0 - 3	81	2.429	3.799	4.501	5.300	6.293	7.706	8.921
3 - 6	84	2.724	3.488	4.394	5.253	6.164	7.414	8.178
6 - 9	120	3.384	3.967	4.638	5.642	6.740	8.049	9.090
9 - 12	107	3.431	3.852	4.360	5.196	6.003	6.989	7.938
12 - 15	100	3.238	3.648	4.234	4.939	5.746	6.567	8.265
15 - 18	97	3.141	3.494	3.889	4.620	5.470	6.335	7.478
18 - 21	96	3.240	3.705	4.244	5.024	5.798	6.737	7.749
21 - 24	94	3.725	4.089	4.371	4.948	5.600	6.649	7.839
24 - 27	76	3.241	3.638	4.128	4.577	5.216	6.364	7.160
27 - 30	93	3.176	3.606	4.090	4.811	5.630	6.744	7.527
30 - 33	83	2.786	3.492	3.943	4.784	5.584	6.549	8.903
33 - 36	92	3.405	3.833	4.268	4.861	5.694	6.520	7.423
36 - 39	106	3.103	3.489	3.920	4.514	5.729	6.934	8.980
39 - 42	77	3.077	3.582	3.936	4.626	5.536	6.770	7.686
42 - 45	71	3.055	3.486	3.924	4.667	5.499	6.699	7.678
45 - 48	96	2.770	3.281	3.728	4.194	5.169	5.970	7.288
48 - 51	80	2.838	3.274	3.743	4.226	4.733	5.776	6.848
51 - 54	90	2.806	3.231	3.822	4.378	5.057	5.866	7.810
54 - 57	61	2.715	3.099	3.572	4.177	4.594	5.613	6.937
57 - 60	65	2.866	3.182	3.568	4.038	4.560	5.044	5.691
60 - 63	137	2.702	3.154	3.659	4.137	4.801	5.488	6.322

Table 80

MEAN SUPRAILIAC SKINFOLD THICKNESS (MM) PERCENTILE BY AGE AND SEX

CHILD GROWTH SURVEY – AMMAN

AGE(MONTHS)		**3**	**10**	**25**	**50**	**75**	**90**	**97**
					F E M A L E S			
0 - 3	85	2.745	3.229	3.892	4.978	5.622	7.602	8.84[illegible]
3 - 6	95	3.287	3.954	4.704	5.626	6.822	7.777	8.967
6 - 9	87	3.327	4.155	4.782	5.572	6.364	6.897	7.6[illegible]4
9 - 12	91	3.714	4.159	4.652	5.347	6.135	7.323	8.468
12 - 15	94	3.234	3.679	4.137	4.758	5.855	6.602	7.133
15 - 18	101	2.880	3.677	4.191	4.910	5.496	6.258	7.332
18 - 21	71	3.417	3.799	4.295	5.096	5.854	6.848	7.676
21 - 24	83	3.480	3.774	4.211	4.812	5.511	6.549	[illegible]
24 - 27	115	3.343	3.822	4.358	5.320	6.346	7.131	8.057
27 - 30	69	3.331	3.970	4.483	5.045	6.125	7.349	10.309
30 - 33	92	3.527	3.966	4.602	5.313	6.250	8.060	9.167
33 - 36	82	3.172	3.836	4.421	5.500	6.500	7.310	9.208
36 - 39	95	3.602	3.916	4.392	5.208	6.092	7.092	8.136
39 - 42	72	3.423	3.760	4.242	5.121	5.614	6.653	8.182
42 - 45	73	3.575	3.907	4.439	5.045	5.882	7.503	8.98[illegible]
45 - 48	92	3.248	3.633	4.081	4.642	5.530	6.840	8.390
48 - 51	85	2.970	3.360	4.150	4.940	5.634	6.751	[illegible].499
51 - 54	58	2.752	3.280	3.869	4.706	5.545	6.547	7.110
54 - 57	40	3.065	3.357	3.860	4.362	4.951	6.688	7.173
57 - 60	66	3.129	3.529	3.891	4.418	5.381	6.276	7.738
60 - 63	157	3.061	3.379	3.968	4.497	5.328	6.307	7.37[illegible]

e. Discussion of the 0-5 Years Weight and Height Growth Pattern: The pattern of growth in weight during the first nine months of life of the Jordanian child appeared satisfactory and comparable with that reported in countries with higher socio-economic standards. Such a finding proves the efficiency of breast milk as a main food during the first six months of life. Similar findings of normal growth patterns during the first three to six months of life where babies are mostly breastfed have been reported in Kampala and other areas in Asia and Africa (Welbourn, 1951; Brock and Autret, 1952; Millis, 1953).

The Jordanian child showed a drop in the mean weight increments after the age of six to nine months. At this age the difference in the mean body weight between children in most of the developed countries and in the developing countries including Jordan and Egypt increased rapidly to reach its greatest value by the end of the second year when it started to regress.

During the fourth year the Jordanian malesgained more weight than the American males and females. The mean body weight of the Jordanian child was, however, still lower than that of the American child.

During the second half of the first year and during the second year, the breast milk was regarded as insufficient or most of the mothers became pregnant again. Cow's milk, mainly in its powdered form is usually started by that time. Breast feeding was either stopped abruptly or continued with the new food supplements for variable time intervals.

The introduction of new foods other than milk together with breast feeding was shown to have a favourable effect on the growth of the child in Jordan (ICNND, 1964). However, the choice of food in this community was limited by its availability and its price; while meats were not widely used, eggs, rice, bread and other cereals, fruits and vegetables were commonly used. It is at this age that repeated episodes of vomiting and diarrhoea started and failure to thrive ~~was~~ observed. By the end of the second year, the difference in the mean body weight between the Jordanian child and other children of comparable age in the USA was considerable. A similar phenomenon of failure to gain weight during this period has been reported again in many of the developing countries. Welbourn (1951) showed that in Kampala the African children start to become retarded from six months of age. Brock and Autret (1952) found that the weight in the first nine months was more or less the same as in Europeans, but after the ninth month it started to deviate. Millis (1953) reported that Chinese children in Singapore have the same weight as Caucasians till six months of age; then they lag behind and have less weight. Gounelle and Demarchi (1953) reported that Iraqi children lag behind the European measurements after six months.

During the third year the average Jordanian child is usually completely off the breast and then gets his share of the mixed family diet. The child is then able to express his hunger and reach for food; also by this age, the child has passed the critical period when he is most at risk to infections. It is then that the mean body weight becomes closer to the American weight. This rebound phenomenon may be due to incomplete satisfaction of the growth potential during the later part of the first year and second year which is then being fully satisfied by the more nutritious and complete adult diet.

During the fourt and fifth year the child is usually getting the ordinary mixed family diet. The increments are satisfactory. However, the deficit in the mean body weight continues and the body weight curve continues to lag behind that of the American child.

When we examine the length pattern of the children in this study, an almost identical trend to that of body weight is found. The lag both in the rate of increase in length and in attained length could be attributed to the prolongation of breast feeding during the first two years of life without introduction of solid foods. The explanation given for the higher rate of increase in body weight after the third year is also applicable here.

f. CORRELATION COEFFICIENTS ON ANTHROPOMETRIC MEASUREMENTS

Tabulations of the correlation coefficient of each measurement with the other anthropometric data are shown in Tables 81 to 88 The most important conclusions revealed the following:

1. With very few exceptions, noted below, significant positive correlations are found between the various body measurements. In a sample of this size, it would be surprising if this were not so. More important is to remark on the magnitude of these correlations · as, although statistically significant in the conventional sense, some are so low as to be of little practical value.

2. The relationship between different measurements was consistently better for the age group 0-6 months than in the later age group.

3. The correlations with height are generally very low or insignificant; this is probably due to the nature of height as an attained stable measurement. It is to be used as a reference, with which to compare other body measurements. Weight is naturally strongly correlated with height and weight/height is examined separately below (5).

4. It is remarkable that the relation between skinfolds and weight (or even weight/height) is not stronger. The highest consistent correlations are found in the arm circumference measurements, which perhaps indicates that this might be a particularly useful measure of adiposity, perhaps considered in relation to the childrens' height.

5. Weight/height is the only composite figure tabulated, and is naturally strongly correlated with weight. The negative correlations found when considering weight/height

and height, and indeed the extremely variable pattern of these correlations throughout the age range, probably indicate changing growth pattern in children as they grow during the first 60 months. Thus, inthe 24-36 month group, the taller children have not put on weight proportionately, and it may be that this indicates a growth spurt in some children in this period. Otherwise, the positive correlation of height with weight/height indicates that taller children are relatively heavier than short ones. This might suggest that this population is marginally malnourished, i.e. children who are less stunted are also less wasted.

Table 81

CORRELATION COEFFICIENTS OF WEIGHTS WITH

OTHER ANTHROPOMETRIC DATA BY AGE FOR MALES

	0-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Weights	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heights	0.852	0.467	0.547	0.581	0.511	0.668	0.679	0.506
Arm cir.	0.703	0.525	0.565	0.570	0.503	0.585	0.642	0.666
Triceps	0.490	0.181	0.210	0.192	0.218	<u>0.024</u>	0.216	0.123
Subscap.	0.347	0.314	0.358	0.183	0.302	0.173	0.335	0.217
Tri. + Sub.	0.471	0.265	0.308	0.221	0.277	0.110	0.285	0.175
Wt./Ht.	0.964	0.956	0.874	0.923	0.374	0.909	0.858	0.604

Values underlined are not significantly different from zero at the 5 per cent level

All values except the underlined are significant at 1 per cent level

Table 82

CORRELATION COEFFICIENTS OF WEIGHTS WITH OTHER ANTHROPOMETRIC DATA BY AGE FOR FEMALES

	0-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Weights	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heights	0.847	0.649	0.594	0.503	0.602	0.637	0.638	0.647
Arm cir.	0.616	0.552	0.559	0.587	0.667	0.502	0.661	0.760
Triceps	0.507	0.121	0.248	0.296	0.399	0.119	0.320	0.418
Subscap.	0.276	0.137	0.275	0.240	0.348	0.045	0.301	0.283
Tri. + Sub.	0.452	0.147	0.301	0.313	0.422	0.103	0.358	0.406
Wt./Ht.	0.973	0.921	0.923	0.721	0.851	0.860	0.834	0.893

All values are significant at 1 per cent level

Table 83

CORRELATION COEFFICIENTS OF HEIGHTS WITH OTHER ANTHROPOMETRIC DATA BY AGE FOR MALES

	0-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Weights	0.852	0.467	0.547	0.581	0.511	0.668	0.679	0.506
Heights	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Arm cir.	0.543	0.333	0.378	0.218	0.172	0.438	0.336	0.236
Triceps	0.396	<u>0.020</u>	0.058	0.054	-0.063	<u>-0.008</u>	-0.087	-0.151
Subscap.	0.182	<u>0.013</u>	0.111	<u>-0.025</u>	<u>-0.019</u>	-0.083	<u>-0.037</u>	<u>-0.014</u>
Tri. + Sub.	0.333	<u>0.019</u>	0.091	<u>0.023</u>	-0.051	-0.051	-0.074	-0.113
Wt./Ht.	0.694	0.194	0.088	0.230	-0.567	0.302	0.215	-0.358

Values underlined are not significantly different from zero at the 5 per cent level

All values except the underlined are significant at the 1 per cent level

Table 84

CORRELATION COEFFICIENTS OF HEIGHTS WITH OTHER ANTHROPOMETRIC DATA BY AGE FOR FEMALES

	0-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Weights	0.847	0.649	0.594	0.503	0.602	0.637	0.638	0.647
Heights	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Arm cir.	0.547	0.316	0.258	0.276	0.308	0.377	0.344	0.415
Triceps	0.431	-0.162	0.157	0.052	0.143	-0.014	-0.005	0.157
Subscap.	0.212	-0.163	0.001	-0.074	0.048	-0.078	-0.069	0.037*
Tri. + Sub.	0.374	-0.187	0.110	-0.003	0.114	-0.048	-0.040*	0.115
Wt./Ht.	0.711	0.307	0.246	-0.204	0.104	0.163	0.112	0.249

Values underlined are not significantly different from zero at the 5 per cent level

*Significant at the 5 per cent level

All other values are significant at the 1 per cent level

Table 85

CORRELATION COEFFICIENTS OF WEIGHT/HEIGHT WITH

OTHER ANTHROPOMETRIC DATA BY AGE FOR MALES

	0-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Weights	0.964	0.956	0.874	0.923	0.374	0.909	0.858	0.604
Heights	0.694	0.194	0.088	0.230	-0.567	0.302	0.215	-0.358
Arm Cir.	0.720	0.482	0.471	0.582	0.262	0.503	0.603	0.478
Triceps	0.503	0.205	0.211	0.203	0.220	0.035*	0.323	0.254
Subscap.	0.406	0.354	0.358	0.236	0.216	0.262	0.438	0.184
Tri. + Sub.	0.508	0.299	0.308	0.254	0.241	0.166	0.400	0.255
Wt./Ht.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

*Significant at 5 per cent level

All other values significant at 1 per cent level

Table 86

CORRELATION COEFFICIENTS OF WEIGHT/HEIGHT WITH OTHER ANTHROPOMETRIC DATA BY AGE FOR FEMALES

	0-6	6-12	12-18	18-24	24-36	36-48	46-60	60+
Weights	0.973	0.921	0.923	0.721	0.851	0.860	0.834	0.893
Heights	0.711	0.307	0.246	-0.204	0.104	0.163	0.112	0.249
Arm Cir.	0.608	0.535	0.567	0.446	0.661	0.383	0.605	0.727
Triceps	0.508	0.237	0.234	0.293	0.403	0.152	0.410	0.428
Subscap.	0.298	0.260	0.345	0.322	0.398	0.091	0.436	0.334
Tri. + Sub.	0.463	0.284	0.324	0.351	0.449	0.148	0.485	0.439
Wt./Ht.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

All values significant at 1 per cent level

Table 87

CORRELATION OF COEFFICIENTS OF ARM CIRCUMFERENCES WITH OTHER ANTHROPOMETRIC DATA BY AGE FOR MALES

	0-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Weights	0.703	0.525	0.565	0.570	0.503	0.585	0.642	0.666
Heights	0.543	0.333	0.378	0.218	0.172	0.438	0.336	0.236
Arm Cir.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Triceps	0.542	0.440	0.305	0.501	0.497	0.381	0.477	0.248
Subscap.	0.517	0.434	0.453	0.491	0.486	0.439	0.491	0.349
Tri. + Sub.	0.587	0.487	0.416	0.582	0.544	0.488	0.527	0.317
Wt./Ht.	0.720	0.482	0.471	0.582	0.262	0.503	0.603	0.478

All values are significant at 1 per cent level

Table 88

CORRELATION COEFFICIENTS OF ARM CIRCUMFERENCES WITH OTHER ANTHROPOMETRIC DATA BY AGE FOR FEMALES

	0-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Weights	0.616	0.552	0.559	0.587	0.667	0.502	0.661	0.760
Heights	0.547	0.316	0.258	0.276	0.308	0.377	0.344	0.415
Arm cir.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Triceps	0.617	0.370	0.376	0.384	0.582	0.363	0.520	0.524
Subscap.	0.472	0.321	0.470	0.388	0.493	0.333	0.528	0.421
Tri. + Sub.	0.614	0.404	0.481	0.444	0.609	0.410	0.602	0.544
Wt./Ht.	0.608	0.535	0.567	0.446	0.661	0.383	0.605	0.727

All values are significant at the 1 per cent level

9. MEASUREMENTS OF CHILDREN ACCORDING TO THEIR BIRTH ORDER

Measurements of weight, height, head circumference, arm circumference and skinfold thickness (triceps, biceps, subscapular and suprailiac) were taken for children during the age period 0-27 months and according to the birth order 1 to 12 for the two sexes separately and combined. The number, mean and standard deviations of all these measurements according to different age periods were calculated, but not all have been included in the appendix. We present here only tables related to weight and height measurements for the two sexes combined as an example of the statistical testing procedure which was carried out for these two measurements.

In Tables 89 & 90 the statistical procedure was as follows: the highest and the lowest values of the mean weight and height were compared by the use of 't' test, if the two measurements showed significant differences then the highest and the next to the lowest were tested and so on. However, if the highest and the lowest mean values were not significantly different, then it would be assumed that there was no significant difference between the means in the different birth orders of that age period.

The results of this statistical approach showed no significant differences between the mean weights and heights of the different age groups according to the birth order 1 to 12.

Table 89

CHILDREN'S WEIGHT (KG) BY AGE AND BIRTH ORDER (SEX COMBINED)

CHILD GROWTH SURVEY - AMMAN

AGE (MONTH)		= 1 =	= 2 =	= 3 =	= 4 =	= 5 =	= 6 =	= 7 =	= 8 =	= 9 =	= 10 =	= 11 =	= 12 =
		BIRTH ORDER											
0- 3	NO.	11	17	27	20	19	23	27	13	5	3	4	2
	MEAN	4.865	4.600	4.287	4.987	4.392	4.621	4.633	4.476	4.309	4.733	4.772	3.370
	S.D	0.989	0.793	0.732	1.308	1.035	1.056	1.061	0.985	0.716	1.700	0.589	0.294
3- 6	NO.	29	27	22	28	11	27	11	10	7	4	1	3
	MEAN	6.569	6.092	6.027	6.420	6.250	6.532	6.664	5.933	5.751	5.145	5.590	7.360
	S.D	1.209	1.262	1.309	1.162	1.336	1.151	1.575	0.774	1.187	0.533	0.001	0.311
6- 9	NO.	33	23	28	24	33	23	14	14	11	1	3	1
	MEAN	7.411	7.542	7.426	7.307	7.438	7.662	7.081	7.371	7.120	7.350	7.635	7.649
	S.D	1.267	1.371	1.135	1.211	1.152	1.034	1.213	1.177	1.139	0.000	1.155	0.000
9-12	NO.	28	21	29	34	21	16	25	14	13	[illegible]	1	1
	MEAN	8.095	8.273	8.337	8.490	7.852	8.726	8.361	8.670	8.139	7.964	7.729	9.650
	S.D	1.398	1.410	1.262	1.003	0.781	1.243	1.147	1.407	0.992	1.756	0.000	0.000
12-15	NO.	23	24	27	21	37	35	17	13	11	4	0	1
	MEAN	8.750	8.562	8.586	9.177	8.783	9.280	8.722	8.649	8.704	9.607	0.000	7.900
	S.D	1.334	1.406	1.163	1.264	1.554	1.230	1.136	0.780	1.254	1.037	0.000	0.000
15-18	NO.	32	32	24	29	20	13	20	14	7	3	2	1
	MEAN	9.386	9.451	9.264	9.164	9.066	9.436	9.379	9.707	9.617	8.607	9.365	9.400
	S.D	1.020	1.766	1.488	1.036	1.151	1.488	1.190	0.904	1.682	1.974	1.152	0.000
18-21	NO.	25	18	23	20	27	21	18	13	4	3	0	1
	MEAN	10.249	9.502	10.674	9.954	10.014	10.164	10.837	9.001	10.487	10.030	0.000	10.700
	S.D	1.268	1.480	1.477	1.663	0.982	1.318	1.851	1.018	1.118	0.715	0.000	0.000
21-24	NO.	25	23	22	16	27	27	16	11	8	3	0	1
	MEAN	10.720	9.625	10.760	10.811	10.786	10.467	10.434	10.907	10.308	10.163	0.000	8.700
	S.D	1.197	1.391	1.178	1.610	1.400	1.574	1.416	2.139	1.235	0.617	0.000	0.000
24-27	NO.	17	26	31	35	26	18	21	13	7	5	3	1
	MEAN	11.168	10.761	11.083	10.815	11.148	10.951	10.866	11.076	11.322	11.487	10.283	11.690
	S.D	1.502	1.206	0.793	1.412	1.291	1.215	1.275	1.848	1.025	1.119	0.550	0.000

Table 90

CHILDREN'S HEIGHT TEST BY AGE ,BIRTH ORDER [illegible]

CHILD GROWTH SURVEY - AMMAN

AGE (MONTH)		BIRTH ORDER = 1 =	= 2 =	= 3 =	= 4 =	= 5 =	= 6 =	= 7 =	= 8 =	= 9 =	= 10 =	= 11 =	= 12 =
0- 3	NO.	11	17	27	20	19	23	27	13	5	4	4	2
	MEAN	55.190	55.635	55.248	57.460	54.442	54.878	56.037	55.384	58.799	57.033	55.650	56.450
	S.D	3.810	2.415	4.169	5.243	4.034	4.947	3.783	2.900	2.188	4.561	2.408	0.213
3- 6	NO.	29	27	22	28	11	27	11	10	7	4	1	3
	MEAN	62.913	61.670	61.304	61.914	62.090	63.644	63.618	61.826	61.100	59.650	61.500	65.633
	S.D	3.003	4.073	4.045	3.401	4.033	5.230	4.016	2.735	4.404	3.671	0.007	1.171
6- 9	NO.	32	23	28	24	33	23	14	14	12	7	3	1
	MEAN	66.584	66.782	65.742	65.475	66.890	66.264	68.842	66.428	67.308	64.443	66.500	66.600
	S.D	3.792	3.515	3.582	3.677	3.071	3.425	7.055	3.146	4.243	1.464	1.466	0.007
9-12	NO.	28	22	29	34	21	16	25	14	13	2	1	1
	MEAN	69.221	69.245	70.044	69.935	69.347	71.287	69.856	69.728	70.207	69.000	67.500	73.300
	S.D	4.254	5.117	2.355	2.732	1.856	2.401	3.897	2.494	3.963	0.282	0.003	0.004
12-15	NO.	22	24	27	20	32	34	17	13	11	4	0	1
	MEAN	73.281	72.016	73.844	73.520	72.687	73.465	72.568	71.215	73.609	74.724	0.000	72.400
	S.D	3.225	3.688	6.169	3.450	4.166	3.575	3.673	4.590	2.466	2.997	0.000	0.009
15-18	NO.	31	32	25	29	20	19	20	14	7	3	2	1
	MEAN	75.348	75.693	74.900	74.831	75.419	76.173	75.875	76.121	76.328	72.633	74.850	75.600
	S.D	3.546	4.470	4.686	3.666	2.901	3.823	2.978	3.447	3.669	5.188	4.171	0.009
18-21	NO.	25	18	24	20	27	21	17	14	4	3	0	1
	MEAN	78.059	76.244	77.512	75.684	77.866	77.361	79.288	79.335	79.049	74.733	0.000	79.003
	S.D	6.923	3.745	9.400	10.360	2.683	3.711	3.142	5.209	4.615	1.379	0.000	0.005
21-24	NO.	25	22	21	18	26	27	17	11	8	3	0	1
	MEAN	80.923	77.786	80.547	81.561	80.061	80.022	79.711	80.763	80.300	73.233	0.000	77.400
	S.D	3.781	5.254	3.275	6.034	3.443	4.738	3.935	4.604	4.614	6.377	0.000	0.004
24-27	NO.	16	26	31	35	26	18	21	13	7	3	3	1
	MEAN	82.218	81.646	81.216	80.854	81.242	81.838	80.566	82.307	82.557	82.050	81.266	81.300
	S.D	3.823	3.948	6.030	5.113	3.833	3.066	4.365	4.311	3.318	1.644	1.616	0.003

The next approach was to test the difference between the mean weight and height measurements for the two sexes combined for birth orders grouped as 1 to 5 and 6 to 12, as shown in Table 91. The results of this testing procedure did not show a significant relationship.

Our results were different from results reported from Egypt (Abbassy, 1972) which showed that there was an effect of birth order on body weight which was present during the first three months of life and then disappeared. For children over three months, this pattern of birth order measurements was similar in the two countries, i.e. the first born child was as heavy as the eighth child.

Table 91

CHILDRENS' MEAN WEIGHTS (Kg) AND HEIGHTS (Cm)

AGE AND BIRTH ORDER (SEXES COMBINED)

Weights

Age (months)	Birth order 1 - 5			Birth order 6 - 12			P
	No.	Mean	S.D.	No.	Mean	S.D.	
0 - 3	94	4.5	0.97	77	4.5	0.87	N.S.
3 - 6	117	6.2	1.12	63	6.0	1.59	N.S.
6 - 9	141	7.4	1.18	71	7.5	1.30	N.S.
9 - 12	133	8.1	1.13	72	8.2	1.08	N.S.
12 - 15	127	8.7	1.30	81	9.1	1.05	5%
15 - 18	137	9.2	1.24	68	9.4	1.33	N.S.
18 - 21	113	10.0	1.30	60	10.2	1.18	N.S.
21 - 24	115	10.5	1.36	68	10.5	1.36	N.S.
24 - 27	135	10.9	1.2	67	10.9	1.13	N.S.

Heights

Age (months)	Birth order 1 - 5			Birth order 6 - 12			P
	No.	Mean	S.D.	No.	Mean	S.D.	
0 - 3	94	55.5	3.90	77	55.4	2.95	N.S.
3 - 6	117	61.9	3.68	63	62.3	3.50	N.S.
6 - 9	140	66.2	3.46	73	66.6	3.20	N.S.
9 - 12	134	69.5	3.22	72	70.0	1.82	5%
12 - 15	125	73.0	4.08	80	72.9	2.81	N.S.
15 - 18	137	75.2	3.80	54	75.4	3.20	N.S.
18 - 21	114	77.0	6.58	60	78.1	2.88	1%
21 - 24	112	80.1	4.30	67	79.5	4.05	5%
24 - 27	134	81.4	4.52	68	81.5	2.68	N.S.

S.D. = Standard Deviation; N.S. = Not significant

h. COMPARISON BETWEEN MEASUREMENTS IN 1964 AND 1974

It was shown in the section on objectives of the study, that one of the purposes of this study was to demonstrate changes if there are any in the growth pattern of children ten years after the last survey. However, it should be remembered that 1964 measurements represent children from MCH centres from all over Jordan. We have compared the measurements of weight, height and head circumference, the only measurements available for comparative purposes in the 1964 study, in the two years and also in males and in females.

Results:

Tables 92, 93 and 94 show the numbers and means for weights, heights and head circumferences of male and female children in 1964 and 1974. Figure 38 shows the mean subscapular skinfold thickness for males and females in this study (1974) and in the 1964 study.

The weight and height measurements show no difference at 0-6 month age intervals. The differences become established at the age of 6-12 months, but have more or less disappeared by the age of 5 years which suggests that the 1964 children caught up well.

In general, measurements of weights and heights show that children in 1974 were significantly heavier and taller than children in 1964; however, the head circumference in 1964 was significantly larger than in the 1974 measurements. Such a difference could result from systematic measurement error.

The statistical approach used to compare the values for the years 1964 and 1974 by the use of the numbers and means in the different age groups only together with the standard deviation only, is presented in the Appendix.

The significance of these results which show marked improvement will be discussed later.

Table 92

MEAN WEIGHTS OF BOTH SEXES - 1964 COMPARED WITH MEAN WEIGHTS - 1974

	Males				Females			
Age (months)	No.	Mean - 1964	No.	Mean - 1974	No.	Mean - 1964	No.	Mean - 1974
0 - 6	153	5.600	165	5.690	126	5.060	182	5.230
6 - 12	352	7.130	226	8.180	286	6.410	177	7.720
12 - 18	290	8.740	201	9.420	231	7.620	196	8.780
18 - 24	194	9.160	191	10.680	154	8.400	154	9.950
24 - 30	147	10.070	170	11.500	121	9.480	184	11.140
30 - 36	84	10.880	175	12.530	59	10.530	174	12.130
36 - 42	108	12.610	185	13.440	83	12.130	166	13.190
42 - 48	38	13.680	168	14.660	18	13.830	166	14.110
48 - 54	75	14.450	170	15.100	73	14.030	144	14.590
54 - 60	27	15.660	127	15.910	21	14.990	107	15.460
60 - 66	67	16.020	138	16.650	82	16.360	158	16.180
Total	1535	9.467	1916	11.848	1254	8.954	1808	11.379
T-value	22.860	SD= 2.811		SD= 3.211	20.247	SD= 3.197		SD= 3.301

Table 93

MEAN HEIGHTS OF BOTH SEXES - 1964 COMPARED WITH MEAN HEIGHTS - 1974

	Males				Females			
Age (months)	No.	Mean - 1964	No.	Mean - 1974	No.	Mean - 1964	No.	Mean - 1974
0 - 6	153	60.800	165	60.000	126	58.800	182	58.090
6 - 12	352	67.500	227	68.940	286	65.600	177	67.340
12 - 18	290	72.800	198	72.800	231	71.200	196	73.370
18 - 24	194	76.600	189	79.490	154	75.400	152	78.050
24 - 30	147	80.100	169	82.700	121	78.800	183	82.190
30 - 36	84	84.100	177	86.790	59	82.600	173	86.040
36 - 42	108	88.200	184	90.240	83	87.300	166	90.440
42 - 48	38	93.500	168	95.270	18	93.300	166	94.300
48 - 54	75	96.600	170	97.200	73	96.100	144	96.470
54 - 60	27	100.600	126	101.740	21	101.400	107	99.750
60 - 66	67	102.700	138	102.600	82	104.400	158	102.990
Total	1535	76.734	1911	84.182	1254	75.968	1804	83.236
T-value	17.860	SD= 11.279		SD= 12.832	14.973	SD= 12.713		SD= 13.530

Table 94

MEAN HEAD CIRCUMFERENCES OF BOTH SEXES - 1964 COMPARED WITH MEANS - 1974

	Males				Females			
Age (months)	No.	Mean - 1964	No.	Mean - 1974	No.	Mean - 1964	No.	Mean - 1974
0 - 6	155	40.600	156	39.980	126	39.400	128	38.910
6 - 12	352	43.800	229	44.120	288	42.500	168	42.620
12 - 18	291	45.900	200	45.600	234	44.400	197	44.390
18 - 24	194	46.700	193	46.610	155	45.400	154	45.260
14 - 30	147	47.700	170	47.050	120	46.100	183	46.330
30 - 36	83	48.000	177	47.670	59	47.000	173	46.720
36 - 42	111	49.100	185	48.170	83	48.200	167	47.230
42 - 48	38	49.600	168	48.880	18	48.900	156	47.560
48 - 54	76	49.700	170	48.890	73	48.900	143	47.690
54 - 60	26	50.200	127	49.190	21	49.300	107	48.450
60 - 66	68	50.300	137	49.400	83	49.900	158	48.500
Total	1541	46.045	1912	46.722	1260	44.889	1734	45.781
T-value	7.362	SD = 2.753		SD= 2.628	8.752	SD = 2.942		SD = 2.604

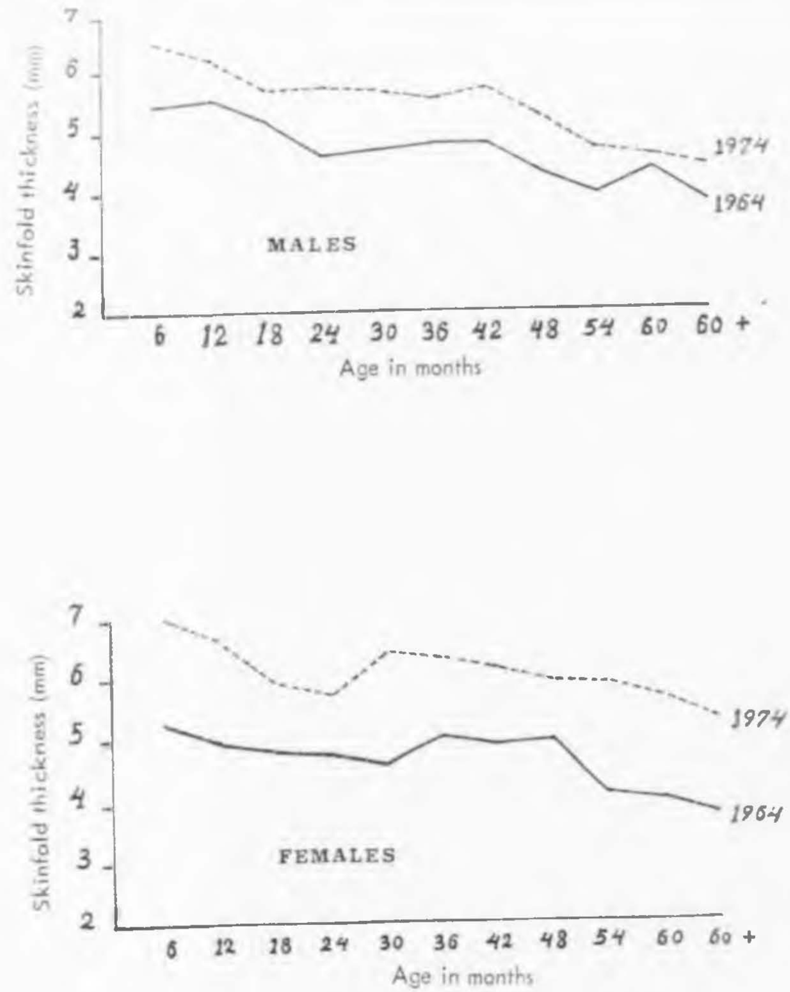
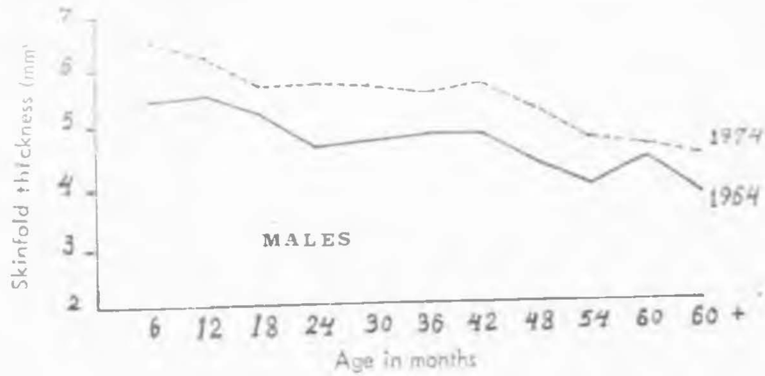


Figure 38 : Mean subscapular skinfold thickness for males and females in this study (1974) and in 1964 study, 0 - 60 months



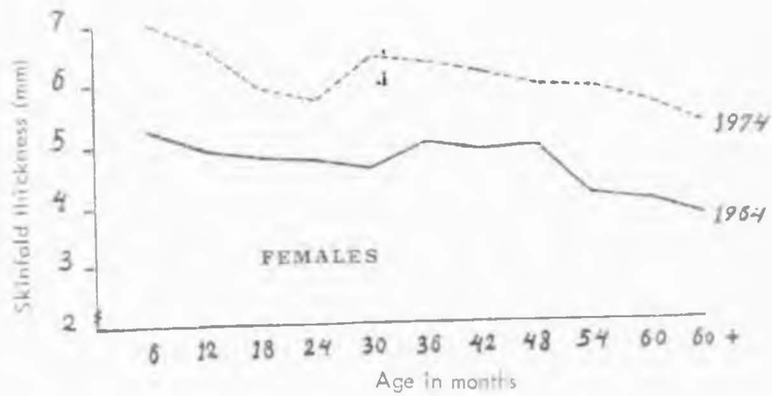


Figure 33 : Mean subscapular skinfold thickness for males and females in this study (1974) and in 1964 study, 0 - 60 months

2. DISCUSSION OF SOME LIMITATIONS OF ANTHROPOMETRIC MEASUREMENTS

I Weight Measurement: The main limitations encountered in weight measurements are related to the following: instrument errors, measurement techniques and weight measurement interpretation.

a. Instrument errors: Jelliffe (1966) had suggested that the weighing scale for measurement of body weight should be accurate to within 0.1 Kg. However, there are several balance scales which can be used.

The problem of recording errors was overcome by Hamill et al. (1972) who used a Toledo self-balancing scale which indicates the weight mechanically to tenths of pounds and made a permanent record to minimise observer and recording errors in measuring the weight of the children. McDowell et al. (1970) used the beam type scales and recorded to the nearest 0.5 pounds.

Finally, one should always remember that good scales are expensive, are poor travellers and there is a need to explain their working system in a proper way to the personnel.

b. Measurement technique: control of the process of weight measurement so as to minimise non-sampling errors was a matter to which considerable effort was directed in this survey. This included steps related to the accuracy of measuring equipment to the training of personnel, to the procedure established for the measurement process, to the care with which they were carried out and to the minimising of recording or transcribing error.

All the information on body weight leads to the conclusion that the results of weight measurement may differ between one technique and another, and depends on the type of weighing scales used because one type of scale weighs more accurately than another. There is also the possibility of an error caused by inaccurate reading during the weighing of the child. Also, checking the scales systematically with a set of standard weights is important. Whenever any discrepancy is detected, the necessary adjustment should be made in order to safeguard the survey against the introduction of measurement error through equipment malfunction.

c. Interpretation of body weight: body weight indicates gross body size (bulk) and gives a rough approximation of body volume. In the clinic body weight should be measured when the accurate age is known; otherwise after the age of two years, body weight measured on its own is not of much help. Tanner et al. (1966) wrote a paper on the assessment of growth, particularly in clinical paediatrics. They give for the first time, standards for height and weight velocity from birth to maturity as well as the height and weight attained at each year of age. These standards are important for judging the normality or otherwise of a child when he is seen on only one occasion.

<u>II Height (Length) Measurement:</u> The main limitations in height measurement are the following:

a. The height (length) measuring scale: Jelliffe (1966) suggested that the measuring scale should be 2 metres long and capable of measuring to an accuracy of 0.5 cm.

Although Jelliffe specified this, there seems to be no good reason why instruments of less than 2 metres should not be used for small children. Indeed, smaller, e.g. 1 metre instruments are available which can be used to an accuracy of 0.1 cm, not 0.5 cm as suggested by Jelliffe.

The instruments used in this study were Infastad for measuring infants and children up to five years and the Harpenden portable stadiomater for measuring adults (see the section on Equipment for further details). However, it should also be emphasised here that these scales are expensive.

b. Measurement technique: Tanner et al. (1966) measured the distance and velocity standards of supine length and height of London children by a slightly different technique from that suggested by Jelliffe. Height was taken with the child stretched maximally, gentle traction being applied under the mastoid process by the examiner. The child stood against the wall on which was fixed a wooden measuring rod marked in millimeters. A right angled block was slid down the wall until the bottom surface touched the child's head. The head was kept in the Frankfurt plane, obtained by telling the child to look straight ahead and stand up straight. The heels were checked to make sure they were on the ground.

c. Interpretation of height measurement: the main limitations encountered in the interpretation of height measurement are related to age, sex, position, time of measurement and seasonal variations.

Palmer (1932) reported that young boys are nearly one centimeter longer when lying than when standing, and he derived equations for relating the values for supine length to erect length. Similarly Tanner et al. (1970) showed that at the age of two years the supine length was approximately one centimeter more than the standing height.

Hamill et al. (1972) measured height at successive half hour intervals during the day and the exact time of each examination was recorded so that possible diurnal effects could be analysed. Height was measured with a Polaroid camera which recorded the subject's identification number next to the pointer on the scale giving a precise reading. It was reported that supine length increased height presumably by relieving gravitational compression. The intervertabral space changes amounted to two centimeters between lying length and standing height. The supine length measured with 'Upward Pressure Technique' recommended by Tanner et al.(1969) was found to produce an increase of one centimeter more than the standing height. This result is similar to the result of Palmer (1932) and also similar to the result of Tanner et al. (1970).

However, when Hamill et al. (1972) repeated all height measurements at two week intervals after the date of the original examination, there was no more than a three millimeter average inter-observer difference for the standing height measurement. This result is consistent with results of another Health Education Survey in the United States where similar procedures were used. The date in this survey suggests that the inter and intra-examiner differences found on repetition of height measurement on the same subjects had median absolute differences of only three or four millimeters (McDowell et al. 1970). Strickland et al. (1972) detected diurnal variations in children's height; the evening height was never found to be greater than the morning height.

III Body Circumferences: These are useful indicators of body build and composition as well as important indices in the evaluation of growth.

In measuring the head circumference, the child's head should be steadied and the greatest circumference measured by placing the measuring tape firmly round the frontal bones above the supra-orbital ridges passing it round the head at the same level on each side, and laying it over the maximum occipital prominence at the back and reading to the nearest 0.1 cm.

The instrument used should be narrow (less than one centimeter wide), flexible, non-stretch tape, made of steel or fibreglass. This tape should be applied to the skin without deforming its contour and placed gently but firmly to avoid compression of the soft tissues.

The arm circumference measurement by Stoudt et al. (1970) was taken from the right side. However, a left handed man has a bigger left arm. In this study, the observer measured the distance from the acromion to the olecranon process. With the zero mark of the tape on the acromion, the tape was allowed to hand free and the mid-point of the acromion - olecranon distance was marked on both sides of the measuring tape. The arm girth measurement was then made horizontally at this level, while the arm was hanging loose and the measuring tape in contact but without deforming the contours at the arm.

In the measurement of body circumference it is expected to get some differences between observers because of inaccurate anatomic locations as well as instrumental errors.

Measurement of body diameter, body girth and other measures involving adipose tissue showed low degrees of correlation with height.

IV Skinfold Thickness: It is well known that height and weight measurements represent a full assessment of the child's physical development. In public health surveys the amount of subcutaneous fat may be the next most important item (Tanner, 1966). Fat content of the human body has physiological and medical importance (Durnin and Womersley, 1974). The methods used for measuring the body fat are based on the assumption that the body consists of two compartments of relatively constant composition, but which are distinctly different; these compartments are (i) the body fat, which includes the entire content of chemical fat or liquids in the body, and (ii) the fat free mass, which includes all the rest of the body apart from fat (Durnin and Womersley, 1974). However, these measurements are difficult and require complex laboratory equipment, and frequent attempts have been made to find a simple technique which will give good agreement with these methods. One possibility involves the measurement of skinfold thickness.

Durning and Rahaman (1967) suggested that the relationship between skinfolds and body density was sufficiently uniform and that tables could be constructed to calculate body fat on this basis in adolescents and young adults. In a following paper, Durnin and Womersley (1974) constructed tables where percentage body fat can be read off corresponding to differing values for skinfold thickness.

However, skinfold thickness has many limitations both in measurement and in interpretation.

1. Measurement Limitations: these includes the following -

a) choice of site - the usual sites for measurement are triceps, biceps, sub-scapular (infrascapular), mid-axillary and suprailiac region.

In general the measurement of skinfold thickness is made at the left side; but some observers still measure on the right side. Womersley and Durnin (1973) did not find significant differences between measurements on the two sides.

One of the major problems of caliper measurements is the lack of agreement among investigators regarding the site at which measurements may be taken. The criteria (Hammond, 1955; Tanner, 1959) commonly followed in selecting a site for measurement are:

i. Ease of making a parallel-sided fold

ii. Convenience to the observed individual (i.e. entailing a minimum of undressing and discomfort).

iii. Representativeness of fat distribution (a combination of limb and trunk is considered to be representative).

The two most commonly used sites are the triceps and sub-scapular (Tanner, 1959; WHO, 1963). In the Canadian survey of 22,000 subjects, the triceps were used as the best single measurement (Pett and Ogilvie, 1956). The Committee on Nutritional Anthropometry of the U.S. National Research Council (1964) recommended the triceps and sub-scapular for general survey use.

In cross-sectional measurement on children and young adults, Hammond (1955) found high correlations (mean $r = 0.75$) between measurements taken at different sites. It was concluded that any one measurement could be substituted for the rest without great loss. Correlations between single sites and total fat were found to be $r = 0.8 - 0.9$. A combination of two sites gave multiple correlations of the order of $r = 0.95$. A combination of three sites increased the multiple correlations to 0.97 or over.

In the reported study, the four sites were measured. The measurements were taken on the left side by the observer and an assistant who were trained together. In most instances, measurements were taken by the main observer, whenever a measurement was doubtful, it was checked by both. No attempt was made to find out the between observer errors. However, the main observer was able to duplicate the readings to within ∓ 0.30 mm. This is consistent with the results observed by Tanner (1959) who stated that the accuracy of measurements over the triceps and sub-scapular is such that a trained individual should duplicate his readings to within 0.3 mm in two thirds of all repeated measurements at the average opening of about 8 mm by the Harpenden skinfold caliper.

b. Measurement errors: there are several modes of instrument with the same basic principle for measuring the skinfold thickness. Actually there is an international agreement that the pressure exerted on the skinfold at the caliper face should be 10 gm/mm^2 and that it should be constant over an average of opening of from 2 mm to at least 40 mm. The calipers can be either round or a rectangular shape and read to the nearest 0.1 mm, but apparently not all calipers conform to this rule. Stoudt et al (1972) measured the right arm triceps and right sub-scapular skinfolds by using the Lange, the Harpenden and the Minnesota calipers on 46 men. The skinfolds were measured by each of the three calipers with identical techniques and the sequence of caliper use was systematically altered. There were differences in the mean values of the three instruments; however, the differences between individual calipers of the same manufacturer were negligible compared with inter-caliper differences. Parizkous et al. (1970) found that two other types of calipers produced different values from one another.

c. Observer errors: Ruiz et al. (1971) used Harpenden calipers and found the differences in skinfold measurements between observers was large. The limitation of accuracy depended on locating the skinfold accurately and also on the manner with which it was picked up. Johnston et al. (1972) suggested that a longitudinal study with a single observer is always preferable; a single observer will provide more constant readings and, therefore, a more accurate estimate of change, but it increases the possibility of systematic bias. In a cross-sectional study, multiple observers are preferable so far as the sub-scapular and mid-axillary skinfold are concerned. The systematic bias introduced by use of a single observer will be eliminated.

Borkinshaw (1973) reported that systematic differences between observers are small and tended to cancel out when the thickness of the four skinfold sites of the body were added (triceps, biceps, infra-scapular and suprailiac skinfold thicknesses). When the site of measurement was marked, it was possible for observers of various degrees of skill to obtain constant readings. Womersley and Durnin (1973) mentioned that in relation to observer-caliper difference, significant differences were obtained by different observers from measurement of the total skinfold and at all sites except for sub-scapular in the men and the left suprailiac in women.

Conclusion: From the published information on skinfold thickness measurements we can conclude that there are differences obtained by observers due to the different types of calipers used. Also, a lack of precision in the identification of the standard measurement point from subject to subject could lead to a large variation in these measurements. Variation in the size of the bite can lead to systematic differences in skinfold thickness.

CHAPTER VI

CLASSIFICATION OF MALNUTRITION-RESULTS AND DISCUSSION

1. Classifications Used in Community Surveys: During the last two decades several systems of classifications have been sugested for both severe forms of protein-energy malnutrition and for use in community surveys. In this section we will limit our discussion to the latter systems.

Gomez et al. (1956) devised a method to group cases of similar prognosis and to guide physicians in selecting a place for treatment. This classification of malnutrition was neither intended for older children nor for field surveys to determine the prevalence in a given community. The system was based on deficit in weight for age expressed as a percentage of standard and it provided for three grades of malnutrition. However, this system was shown to have some disadvantages. Weight loss is the criterion used to identify the malnourished, but the presence of oedema unless carefully excluded, might lead to a wrong conclusion. It was, therefore, suggested that all cases with oedema should be considered as third degree malnutrition (Bengoo, 1970). However, the second disadvantage of this system is that children who have been treated successfully are still underweight for age (because of being stunted in height); thus they may not reach the normal weight for age and continue to be classified as malnourished.

The Gomez classification was modified by Wray (1961) and by Wray and Dara (1964) who put it in a graphical form. Jelliffe, (1966) proposed a classification based on weight for age similar to that of Gomez with changes in the intervals.

Graham (1968) introduced the 'development al quotient' which attempts to relate the developmental age to the chronological age, he calculates the 'developmental age' of the child for weight as the age of a standard child of the same weight. The ratio of developmental age to chronological age is the developmental quotient (DQ) A DQ for height can be calculated in the same way and is then directly comparable with the DQ for weight, because the units are the same. The application of DQ for assessing malnutrition in the first year of life is difficult, because severely malnourished children under one year of age may have a body weight which is close to or even below the normal birth weight. To be able to apply DQ to assess such cases Graham recommended that both chronological age and developmental age should be calculated from conception rather than birth.

McLaren and Read (1972) proposed a classification of nutritional status, based on weight height and age. The relationship of weight and height is expressed by dividing the weight in grams by height in centimeters, and then expressing the results as a percentage of the standard quotient derived from the Harvard data for a child of the same age. This index is essentially a measure of deficit in weight for height. Waterlow (1973) pointed out that a deficit in weight for age, which forms the basis of the Gomez classification is usually a combination of two different elements - deficit in weight for height and deficit in height for age. He suggested the use of the word 'wasted' for the child who is underweight for height, and the word 'stunted' for the child who is below normal height for age; many malnourished children have a combination of wasting and stunting. In his paper Waterlow proposed a simple system by which a child can be classified according to the degree of both wasting and stunting. Both were expressed in terms of the Harvard standards and for both three grades of deficit were proposed (Waterlow, 1972), the cut-off points being inevitably arbitrary.

In a later paper it was suggested that the particular cut-off points of height for age initially chosen were not the most appropriate and a revised grading was proposed (Waterlow, 1973).

In a recent paper, Waterlow and Rutishauser (1974) showed that the relative degress of wasting and stunting can be determined in individual children and in population. To do this a two-way table was constructed and in order to combine the four grades for each condition (normal, mild, moderate and severe) (Waterlow, 1972), the table has to have sixteen cells. In the same paper (Waterlow and Rutishauser, 1974) it was suggested that such a table might be simplified into one of four cells indicating no action, action, priority and query action as is shown in table 95.

Table 95

'The Action Diagram'

No Action	Action
Action ?	Priority

*From Waterlow, J.C. and Rutishauser, I.E. (1974) Malnutrition in Man. In: Early Manutrition and Mental Development, p. 13, Symposia of the Swedish Nutrition Foundation XII. Almquist and Wiksell, Uppsala.

The top left hand corner represents 'normal' children, the bottom right hand corner represents those who are severely malnourished and probably need treatment in hospital or at least in a rehabilitation centre. The bottom left hand and top right hand corners give an indication of the extent of the public health problem.

For our population we used the 'Public Health Classification' suggested in this paper (Waterlow and Rutishauser, 1974) by doing the following:

1. The children were divided into fairly narrow age group as follows: 0 - 6 months, 6 - 12 months, 12 - 18 months, 18 - 24 months, 24 - 36 months, 36 - 48 months, 48 - 60 months and 60+ months. This was done separately for males and females.

2. Each group was classified by the 4 x 4 table as shown in table , (Waterlow and Rutishauser, 1974).

3. Those on the right hand side of the dotted line correspond roughly to the malnourished children in the Wellcome classification (1970).

<u>Selection of Group A and Group B:</u> From the nutritional standpoint and following Morley's terminology (Morley, 1968) in a similar study in Africa, the children in this study were divided into two major groups: Group A, well nourished and Group B, malnourished. However, the children in this study were classified, as mentioned previously, according to Waterlow's Public Health Classification (Waterlow and Rutishauser, 1974).

As is shown in Table 96 the total number of children corresponding to well nourished children (the first two vertical columns on the left hand side of this table, corresponding to Group 0 and Group 1) was 3,643 (98.2 per cent) and the total number of children corresponding to the malnourished children (the second two vertical columns on the left hand side of this table corresponding to Group 0 and Group 1) was 65 (1.8 per cent) children.

This terminology of Group A and Group B was also applied to the children's families, housing, economic status, morbidity, mortality and all the other variables which were used in this study. So, by the term 'mothers in Group A' is meant mothers of the well nourished children according to the classification system explained above.

However, it is worth mentioning here again that the Chi^2 test was the statistical tool which was used when we compared the two groups A and B against the different social, economic and health variables in this study.

Table 97 and histogram 7 shows the male and female children classified according to this system in different age groups (Waterlow and Rutishauser, 1974) into grades of wasting and stunting. Table 96 shows all the children (both sexes combined) classified according to the same system. Histogram 8 shows the percentage of children in the two groups by age and sex.

From Table 97 we can conclude the following:

Table 96

ALL CHILDREN CLASSIFIED ACCORDING TO GRADE OF WASTING AND STUNTING (BOTH SEXES COMBINED)

Stunting	Wasting			
	Group 0	Group 1	Group 2	Group 3
Group 0	965 (26.0)	82 (2.2)	13 (0.3)	17 (0.5)
Group 1	610 (16.4)	114 (3.0)	4 (0.1)	0 (0.0)
Group 2	618 (16.6)	208 (5.6)	3 (0.1)	1 (0.0)
Group 3	634 (17.1)	412 (11.1)	24 (0.6)	3 (0.1)
Total	3643 (98.2)		65 (1.8)	

Figures in parentheses are percentages

Table 97

MALE AND FEMALE CHILDREN CLASSIFIED ACCORDING TO GRADES OF WASTING AND STUNTING IN THE DIFFERENT AGE GROUPS

Values are Percents

		Girls		Boys	
Age group (month)	Degrees	Stunting	Wasting	Stunting	Wasting
0 - 6	0	50.2	88.6	56.6	89.7
	1	16.7	10.6	13.2	9.6
	2	8.9	0.0	10.8	0.6
	3	24.0	0.55	19.2	0.0
6 - 12	0	45.5	87.2	51.1	90.9
	1	18.3	11.6	14.0	8.56
	2	22.2	1.10	11.7	0.45
	3	13.8	0.0	23.0	0.0
12 - 18	0	33.1	80.5	40.5	86.1
	1	24.4	19.3	16.3	12.8
	2	14.2	0.0	20.7	0.49
	3	28.0	0.0	22.2	0.49
18 - 24	0	19.8	78.1	26.3	81.1
	1	15.8	20.5	23.1	18.2
	2	24.4	0.66	29.5	0
	3	39.7	0.66	20.9	0.53

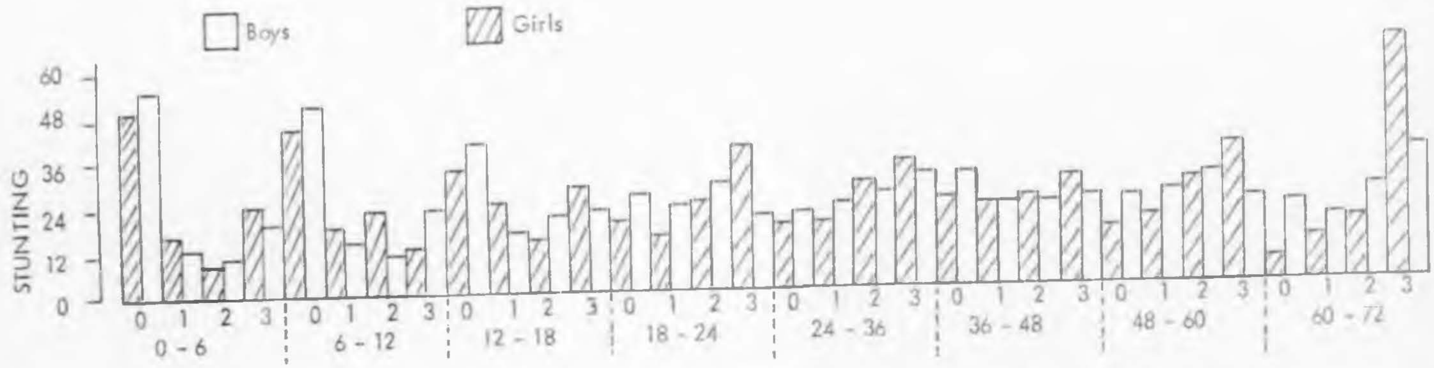
(cont.)

Table 97 (cont.)

Age group (month)	Degrees	Girls Stunting	Girls Wasting	Boys Stunting	Boys Wasting
	0	18.7	65.5	20.5	72.8
	1	18.4	31.9	23.3	23.6
24 - 36	2	28.2	1.96	25.4	2.2
	3	34.4	0.56	30.6	1.1
	0	23.9	70.5	30.5	72.8
	1	22.4	28.1	22.8	24.8
36 - 48	2	24.2	0.6	22.5	1.9
	3	29.3	0.6	23.9	0.28
	0	15.4	65.5	23.4	78.9
	1	18.1	32.7	25.0	20.0
48 - 60	2	28.4	1.1	29.0	0.66
	3	37.9	0.39	22.4	0.33
	0	6.4	64.0	21.4	62.2
	1	11.5	30.7	17.7	33.3
60 - 72	2	16.6	4.4	25.1	1.48
	3	65.3	0.64	35.5	2.96

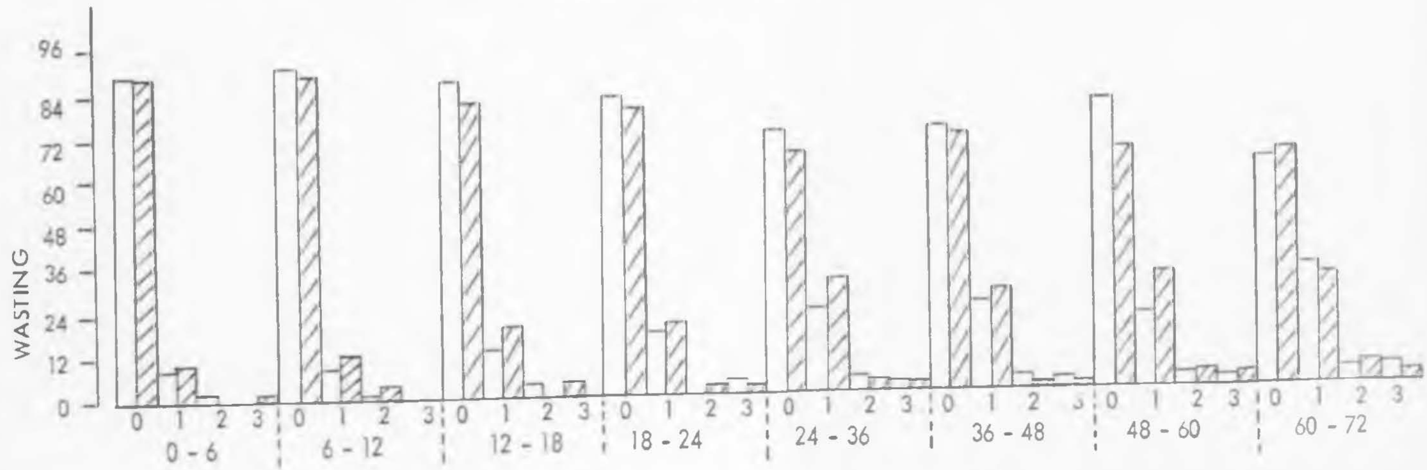
Wasting
0 = more than 90 per cent weight for height (Harvard)
1 = 90 - 80 per cent weight for height "
2 = 80 - 70 per cent weight for height "
3 = Less than 70 per cent weight for height "

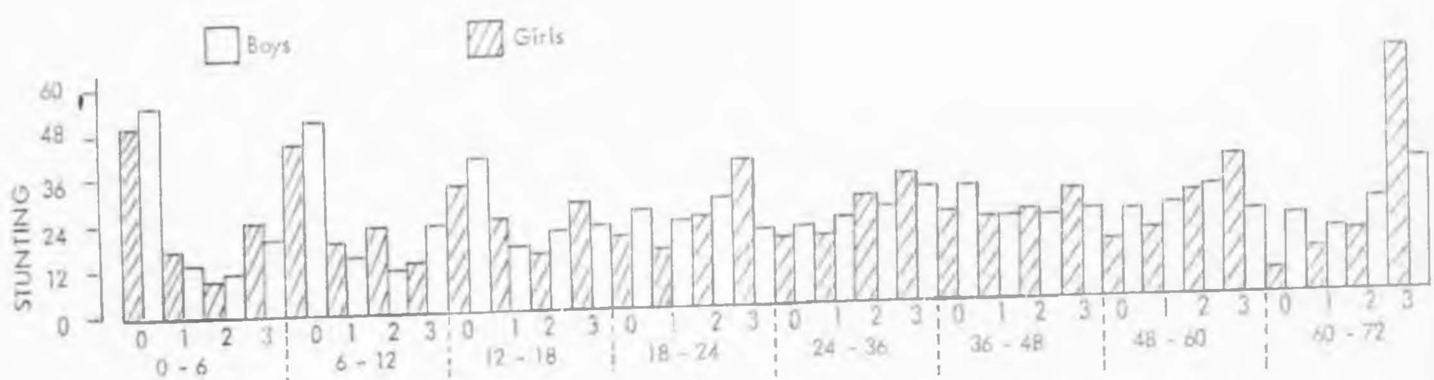
Stunting
0 = more than 95 per cent height for age "
1 = 95 - 90 per cent height for age "
2 = 90 - 85 per cent height for age "
3 = Less than 85 per cent height for age "



CLASSIFICATION OF CHILDREN ACCORDING TO DEGREES OF WASTING AND STUNTING

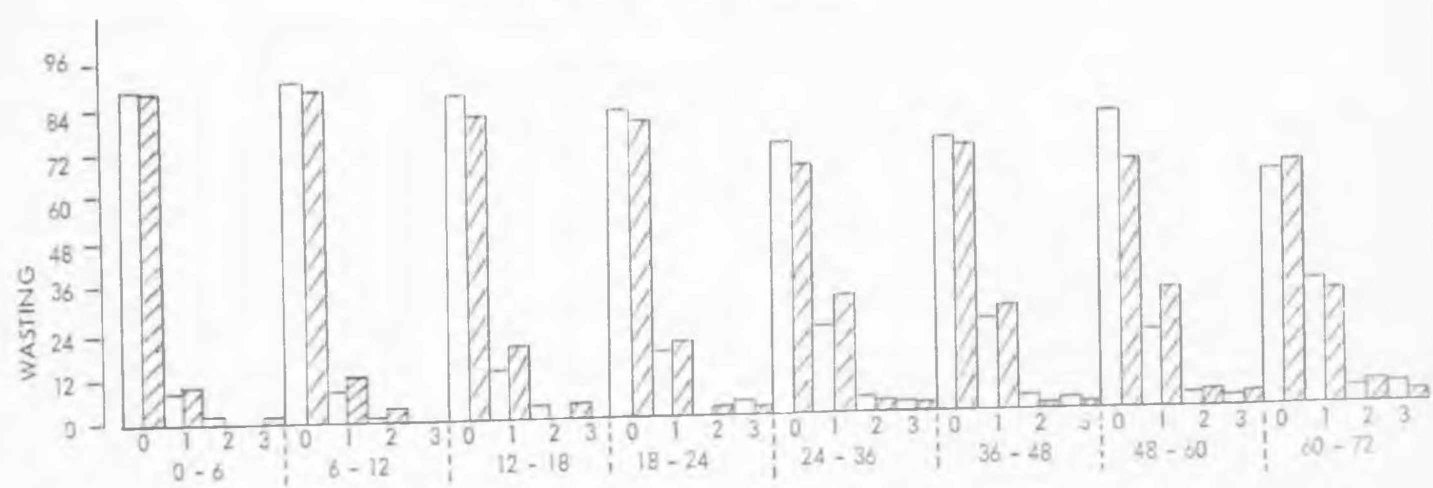
(Waterlow's classification , 1974)





CLASSIFICATION OF CHILDREN ACCORDING TO DEGREES OF WASTING AND STUNTING

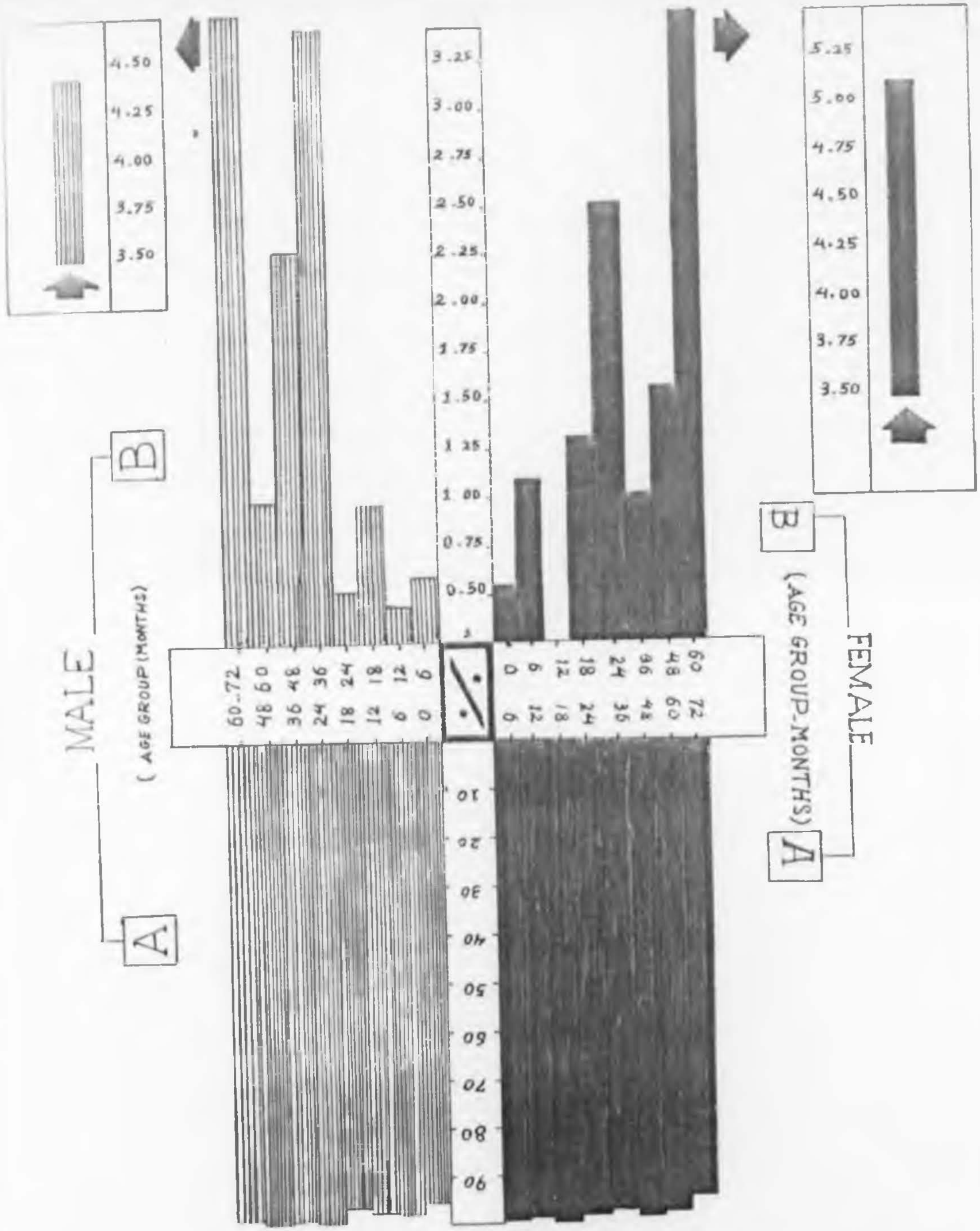
(Waterlow's classification , 1974)



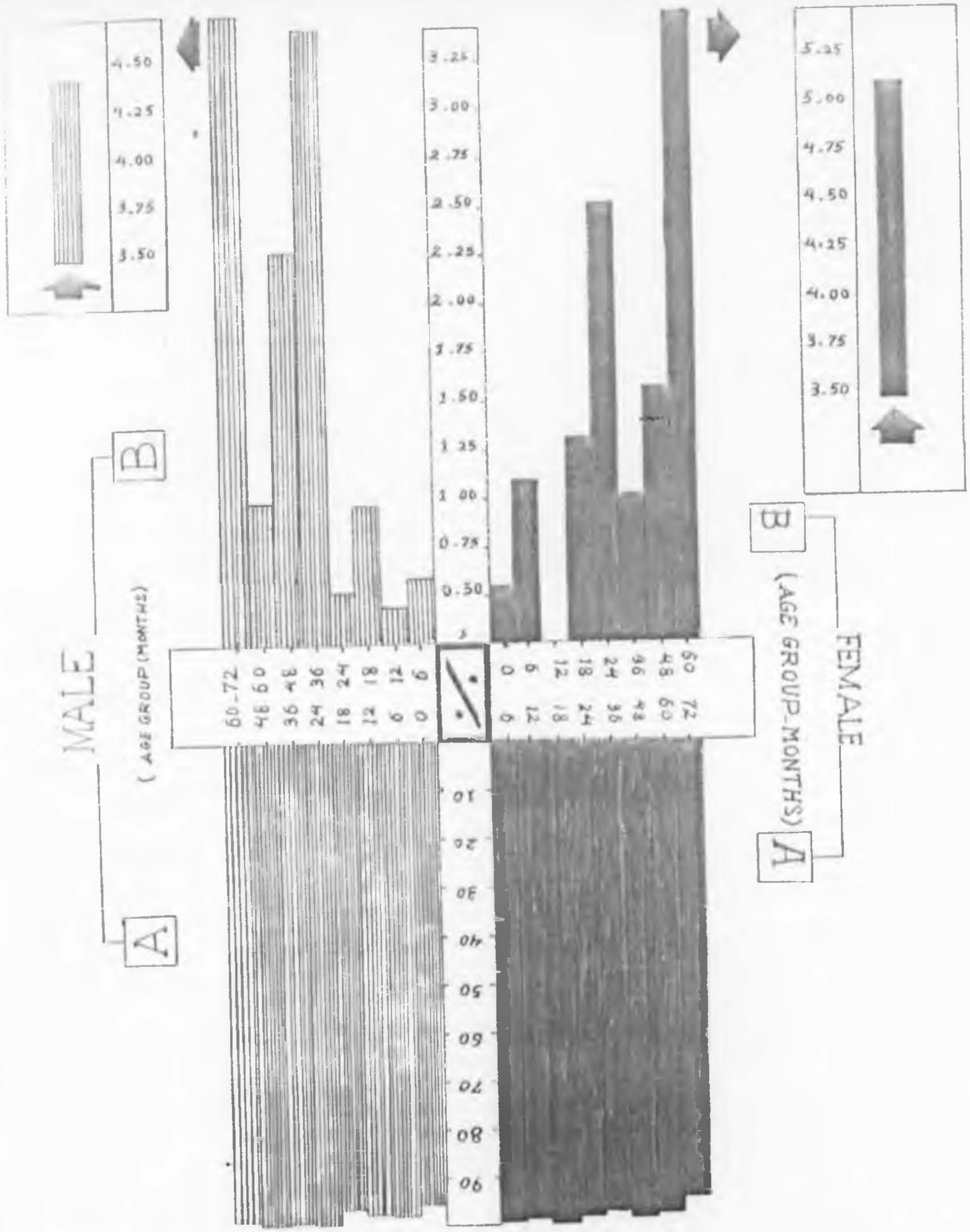
1. Wasting: it has very low frequency, even in the young age group when growth begins to falter (6 - 12 months).

At the age of five and six years a few cases appear for reasons which are not definite or clear. However, it is worth mentioning that during infancy and early childhood of those five and six year old children, the country was undergoing severe internal troubles. Many deaths, displacements, injuries, short periods of food shortage together with poor hygiene and health care were some of the features of those events. It might be suggested that the deprivation imposed on those children during that period might have produced wasting which was probably not followed by a proper 'catch up' period.

2. Stunting: In girls, stunting increases progressively with age. In boys, frequency becomes fairly constant after the age of three years. However, the results show the presence of severe stunting which might have a genetic origin.



Histogram : 8 Percentage of well nourished (A) and malnourished (B) children in different age groups, males and females



Histogram : Percentage of well nourished (A) and malnourished (B)
8 children in different age groups, males and females

2. CLASSIFICATION OF THE SEVERELY MALNOURISHED CHILDREN

Waterlow's Public Health classification (Waterlow and Rutishauser, 1974) was used in this study for classifying the children in the community.

To detect the severely malnourished children the classification system suggested by the Wellcome Working Party (1970) was applied. This system was mainly proposed to classify severely malnourished children as they present for example, at a hospital or clinic or even in the community. The point at which malnutrition begins was defined as a reduction in body weight below 80 per cent of the Boston 50th centiles. This corresponds approximately to the Boston 3rd percentile. The malnourished children were classified according to only two criteria: the presence or absence of oedema and a body weight above or below 60 per cent of Boston standard weight for age (50th centile).

Table 98 shows the number, ages, weights and heights of those severely malnourished children in this study classified according to the Wellcome classification system.

Marasmus in this community was the most common clinical form. The high frequency of marasmus in Jordan was also confirmed especially among hospital admissions (Hijazi, 1974) and in other field studies (Pharaon, Shammout and Hijazi, 1969; McLaren, 1966 and McLaren, 1970).

The age of marasmic children in this community was rather high. For comparison the mean age of marasmic children admitted to hospitals was around seven months. The relatively high age of marasmic children in this community might suggest that these children are suffering from a chronic wasting condition not necessarily due to primary malnutrition; other causes like malabsorption (coeliac), intestinal tuberculosis and/or parasitism might be responsible.

It will also be seen in this Table that these children differed in their weight for height in the same way as they differed in their weight for age. The child who had kwashiorkor was less retarded in height than the children in the other two groups, suggesting that the malnutrition must be of more recent onset. Similar findings were reported by Waterlow (1972) in Jamaica; Graham et al. (1969) in Peru; Shakir et al. (1972) in Baghdad and by Hijazi (1974) in Jordan.

Table 98

NUMBER, AGE (MONTHS), HEIGHTS AND WEIGHTS OF SEVERELY MALNOURISHED CHILDREN GROUPED ACCORDING TO WELLCOME CLASSIFICATION (1970)

	Kwashiorkor	Marasmic - Kwashiorkor	Marasmus
No. of children	1	2	62
Mean age (months)	36.0	25.0	42.4
Percent weight for age	0.74	0.47	0.55
Percent height for age	0.90	0.85	0.84
Percent weight for height	0.82	0.55	0.65

CHAPTER VII

FEEDING PRACTICFS AND WEANING PATTERNS

The feeding practices and weaning patterns of the Jordanian children have been scarcely studied (ICNND, 1964; Hijazi and Mango, 1969). Jelliffe (1955) has referred to the feeding patterns in Syria, Lebanon and other Arab countries, but not to Jordan. The feeding and weaning patterns in these countries are largely similar.

Wide differences in the prevalence of breast feeding in different parts of the world are now evident, although there are indicators of a continuing overall decline (Newson and Newson, 1965; Salber and Feinleib, 1966; Phillips et al. 1969; Knuttson et al. 1969; Planck and Milanesi, 1973; Sanjur et al. 1970). Breast feeding has not decreased in all rural communities since no such social or economic situation exists to favour artificial feeding, nor is processed or safe milk available at a reasonable cost.

1. Feeding Practices and Weaning Patterns - Results

Prevalence of Breast Feeding: Table 99 shows the duration of breast feeding for the observed children in the two nutritional groups. The malnourished children showed a pattern of breast feeding either short (less than six months) or prolonged (more than 24 months). However, 6.4 per cent of all the children has never been breast fed.

Weaning Pattern: Table 100 shows the pattern of weaning among the observed children who were, by the time of the study, already weaned. Abrupt weaning in this text implies complete sudden cessation of breast milk; gradual weaning implies the introduction of bovine milk and solids for some time, together with breast feeding until the baby is completely weaned.

Table 99

DURATION OF BREAST FEEDING AMONG THE TWO NUTRITIONAL GROUPS

Duration of breast feeding (months)	Well nourished Group A	Malnourished Group B	Total
Never breastfed	6.4	5.4	6.4
Less than 6	9.3	10.2	9.7
6 - 12	16.1	17.1	16.6
12 - 18	31.7	40.0	31.9
18 - 24	30.4	20.0	30.2
More than 24	6.0	7.3	6.1

Chi^2 value 3.395; P : N.S.

Values are percents of each group

Table 100

PATTERN OF WEANING* (ABRUPT VERSUS GRADUAL) AMONG THE ALREADY WEANED CHILDREN

	Abrupt		Gradual	
Sex	No.	Percent	No.	Percent
Male	941	69.6	411	30.4
Female	943	70.7	390	29.2
Total	1884	70.2	801	29.8

Chi^2 value 4.821; $P < 0.01$

Values are percents of each group

*See text for meaning of 'weaning pattern'

We were surprised to find a higher prevalence of abrupt weaning (70 per cent) compared to (30 per cent) gradual weaning. Sex differences were not present.

Table 101 shows the number, percent and cumulative percent of children who were completely weaned at different age periods by sex among the observed children. The age of weaning in this table was divided into one month intervals up to the age of 16 months to find out the pattern of weaning at such an early age. There were no significant sex differences among the observed children. The cumulative percent in this table shows that about 60 per cent of the children were weaned before the age of one year. Table 102 shows the weaning age in three month intervals of all the children in the two groups, who were, by the time of the study, already weaned. There were more children in the malnourished group who were weaned before the age of nine months than in the well nourished group. In other words, the early weaning (unphysiological) was more common among the malnourished group.

Weaning Causes: Table 103 is a summary for the different reasons of weaning as cited by the mother among the two nutritional groups. Mother's next pregnancy accounted for more than half the causes. Mother's work was almost never a cause of weaning in this rural community.

Weaning Devices: Table 104 shows the different special weaning devices used by the mothers of the already weaned children. Most of the mothers did not use any weaning device; 30 per cent painted the nipples with different unpleasant tasting materials as a weaning procedure. Some mothers used to hide from their child, so that

Table 101

NUMBER AND PERCENT OF CHILDREN WHO WERE COMPLETELY WEANED* IN DIFFERENT AGE PERIODS BY SEX (0 - 16 MONTHS)

Age (months) when weaned	Males		Females		Total		Cumulative Percent
	No.	Percent	No.	Percent	No.	Percent	
0 - 1	45	3.5	44	3.4	89	3.4	3.4
1 - 2	68	5.3	63	4.9	131	5.1	8.5
2 - 3	47	3.6	61	4.7	108	4.2	12.7
3 - 4	70	5.4	67	5.2	137	5.3	18.0
4 - 5	32	2.5	45	3.5	77	3.0	21.0
5 - 6	60	4.6	59	4.6	119	4.6	25.7
6 - 7	55	4.3	54	4.2	109	4.2	29.9
7 - 8	29	2.2	33	2.6	62	2.4	32.3
8 - 9	57	4.4	50	3.9	107	4.1	36.4
9 - 10	15	1.2	22	1.7	37	1.4	37.9
10 - 11	13	1.00	22	1.7	35	1.4	39.3
11 - 12	262	20.3	251	19.5	513	19.9	59.2
12 - 13	16	1.2	26	2.0	42	1.6	60.9
13 - 14	43	3.3	48	3.7	91	3.5	64.4
14 - 15	46	3.6	39	3.0	85	3.3	67.7
15+	431	33.4	400	31.1	831	32.3	99.9
Total	1289	100.0	1284	100.0	2573	100.0	

Chi^2 value 8.249; P: N.S.

*Complete weaning in this table means complete cessation of breast feeding

Table 102

PERCENT AND CUMULATIVE PERCENT OF WEANED CHILDREN IN THE TWO NUTRITIONAL GROUPS ACCORDING TO THE AGE OF WEANING

	Well nourished Group A		Malnourished Group B	
Age of weaning (months)	Percent	Cumulative Percent	Percent	Cumulative Percent
0 - 3	8.8	8.8	9.3	9.3
3 - 6	12.7	21.5	11.6	20.9
6 - 9	11.4	32.8	20.9	41.8
9 - 12	7.0	39.8	7.0	48.8
12 - 15	5.0	44.8	4.6	53.5
15 - 18	6.0	50.8	7.0	60.4
18 - 21	20.1	71.0	16.3	76.7
21 - 24	0.7	71.7	0.0	76.7
24 - 27	7.4	79.1	7.0	83.7
27 - 30	0.2	79.3	0.0	83.7
30 - 33	0.6	79.9	0.0	83.7
33 - 36	20.0	99.9	16.3	99.9

Chi^2 value 4.753; P : N.S.

Values are percents of each group

Table 103

DISTRIBUTION BY REASON OF WEANING AS CITED BY MOTHERS ACCORDING TO THE TWO NUTRITIONAL GROUPS

Weaning cause	Well nourished Group A	Malnourished Group B	Total
Mother's new pregnancy	56.8	64.4	57.0
Mother's sickness	7.4	6.7	7.3
Mother's work	0.4	0	0.4
Fissure of nipples	1.7	2.2	1.7
Milk insufficiency	15.0	11.1	14.8
Child's sickness	4.0	6.7	4.2
Child old enough	14.7	8.9	14.8

Chi^2 value 3.007; P : N.S.

Values are percent of each group

Table 104

WEANING DEVICES USED BY THE MOTHERS IN THE TWO NUTRITIONAL GROUPS

Weaning device	Well nourished Group A	Malnourished Group B	Total
Painting the nipples	29.7	21.6	29.6
Hide from the baby	11.4	5.4	11.3
Sedatives and calmatives	0.5	0	0.5
Nothing done	58.3	73.0	58.5

Chi^2 value 3.513; P : N.S.

Values are percents of each group

it would forget the breast. The infant used to be sent away from the house, usually for two or three days, but the period of separation sometimes lasted a week or more, to his grandparents or to other close relatives with whom he was well acquainted. In some instances separation took place within the house; the infant was made to sleep with his father, elder sibling or with the grandparents so that he would forget the breast at night when he asked for it most.

The special devices which were used for the weaning process may be divided as follows: devices which frighten by a visual effect: black such as coffee, red such as mercurochrome, tomato paste and henna, and blue such as nileh zerka (a locally used detergent).

Of the substances or objects listed to discourage the infant by affecting the taste, quinine (Sabra murrah, Hilweh, Quinine) was the most used and in some cases spices were used.

In other instances a black brush was put over the breast to frighten by sight and touch. Black hair, either wrapped around the nipple or pasted over the nipple with glycerine, or moistened soap or olive oil or chewing gum, was also used. In some instances, cigarette ashes were painted on the nipple and moistened.

Some mothers used a plastic pacifier as a means of replacement for the breast, and in some others the child was nursed by lactating relative or neighbour for a period of a few days, in order to forget his mother.

Weaning Age and Birth Order: Table 105 shows the percent distribution and cumulative distribution of the children who were already weaned at the time of the study, according to their weaning age and birth order. There was a tendency for children of higher birth order to be weaned after the age of one year.

Introduction of solid foods: Table 106 shows the percent prevalence and the cumulative percent for the two nutritional groups according to the age when solid foods were introduced. Solids were introduced to Group B earlier, but the difference was not significant at the five per cent level.

At the age of one year, 90 per cent of the children in Groups A and B started solids.

Table 107 shows the age at the introduction of solid foods for males and females in the two nutritional groups. The differences were not significant statistically at the five per cent level. Rice, custard, eggs, fruits and vegetables were the main weaning foods in this community.

Table 108 shows the percentages of children in the two nutritional groups who were given the different foods listed as their first solid. Legumes, eggs, vegetables, fish and chicken were used by the well nourished group as a first solid. More malnourished received sweets, yogurt and labneh as their first solid. All these differences were significant at the five per cent level.

Table 105

DISTRIBUTION OF CHILDREN ACCORDING TO THEIR WEANING AGE AND BIRTH ORDER

	Birth Order 1-4		Birth Order 5+		Total		
Weaning age (months)	No.	Percent	No.	Percent	No.	Percent	Cumulative Percent
Less than 6	387	24.8	193	16.7	580	21.4	21.4
6 - 12	323	20.7	174	15.1	497	18.3	39.7
12 - 18	455	29.2	382	33.1	837	30.9	70.6
18 - 24	288	18.5	272	23.6	560	20.6	91.2
24 - 30	90	5.8	114	9.9	204	7.5	98.8
30+	16	1.0	17	1.5	33	1.2	99.9

Table 106

AGE AT INTRODUCTION OF SOLID FOODS FOR THE TWO NUTRITIONAL GROUPS

Age at introduction (months)	Well nourished Group A	Malnourished Group B	Cumulative Percent Group A	Cumulative Percent Group B
1 - 3	11.1	15.9	11.1	15.8
3 - 6	46.2	49.1	57.3	64.9
6 - 9	18.3	12.3	75.7	77.2
9 - 12	17.0	14.0	92.6	91.2
12 - 15	1.3	1.7	93.9	93.0
15 - 18	4.1	3.5	98.0	97.5
18 - 21	0.1	0.0	98.2	97.5
21+	1.8	3.5	99.9	99.9

Chi^2 values 3.769; P : N.S.

Table 107

AGE AT INTRODUCTION OF SOLID FOODS FOR THE MALES AND FEMALES IN THE TWC NUTRITIONAL GROUPS

Age at intro-duction (months)	Males: Well nourished Group A	Males: Malnourished Group B	Females: Well nourished Group A	Females: Malnourished Group B
1 - 6	823 (43.9)	19 (54.3)	792 (44.7)	13 (43.3)
6 - 12	685 (36.6)	12 (34.3)	620 (35.0)	11 (36.7)
12 - 18	261 (14.3)	3 (8.6)	281 (15.9)	2 (6.7)
18 - 24	73 (4.0)	0 (0.0)	51 (2.9)	2 (6.7)
24 - 30	29 (1.6)	1 (2.80)	28 (1.6)	1 (3.3)
	Chi^2 value 3.331; P : N.S.		Chi^2 value 2.756; P : N.S.	

Figures in parentheses are percent of each group

Table 108

FOODS GIVEN TO CHILDREN IN THE TWO NUTRITIONAL GROUPS AS THEIR FIRST FOOD ITEM

First food item given	Well nourished Group A	Malnourished Group B	P of Chi^2 test
Legumes (lentils, chickpeas, etc.)	40.6	37.9	< 0.05
Yogurt, labneh	30.8	41.4	< 0.05
Chicken	17.4	13.8	< 0.05
Fruits	3.7	1.7	< N.S.
Cereals (different brands)	2.2	1.7	< N.S.
Sweets	0.6	1.7	< 0.05
Bread and biscuits	0.2	0.0	< N.S.
Eggs	0.4	0.0	< 0.05
Vegetables	0.3	0.0	< 0.05
Meat	0.1	0.0	< N.S.
Canned baby foods	0.5	0.0	< N.S.

Values are percents of each group

The Present Diet of Children: Table 109 shows a general distribution of some important food items used by the children in the different age groups in their present diet.

Milk: 90 per cent of the children during the first three months of life were receiving milk in their present diet. There was a gradual decline in its use in the following months to 76 per cent of children at the age of two years.

Cereals: 10 per cent of children less than three months old, were receiving cereals and there was a gradual increase in the use of cereals to 85 per cent of children in older age groups.

Fruits and vegetables: 5.4 per cent of all children aged less than three months were receiving fruits and vegetables. The use of these items in the subsequent age groups rapidly increased until it was nearly 100 per cent at the age of two years.

Meat and fish: During the first three months only 3.6 per cent of the children were given meat and fish; it was about 95 per cent at the age of two years. Of all the children in different age groups 76 per cent were eating meat and fish; this is the lowest figure among the food items in this table.

Hommos (parboiled chickpeas): During the first three months of life, 5.4 per cent of the children were being fed hommos, and at the age of two years almost all the children were given hommos.

Eggs: These were widely used. The overall consumption of eggs, was 80.9 per cent, which was more than milk and meat.

DISTRIBUTION OF CHILDREN ACCORDING TO THEIR PRESENT FOOD AND AGE

TYPE(FOOD) AGE(MONTH)	MILK		CEREAL		FRUITS/ VEGETABLES		MEAT FISH		[illegible]		[illegible]		TOTAL	
	NO.	P/C	NO.	P/C	NO.	P/C	NO.	P/C	NO.	P/C	NO.	P/C	NO.	P/C
LESS 3	149	90.3	17	10.3	7	[illegible]	6	3.6	7	5.4	10	[illegible]	165	100.0
3 - 6	166	92.2	69	38.3	44	24.4	20	11.1	27	14.9	31	17.2	180	100.0
6 - 9	193	92.3	136	65.0	107	51.1	50	23.9	80	38.2	79	37.7	209	100.0
9 - 12	187	94.4	154	77.7	130	65.6	68	34.3	110	55.5	111	56.0	198	100.0
12 - 15	182	91.0	156	78.0	153	76.5	113	56.5	137	68.5	140	70.0	200	100.0
15 - 18	170	85.4	168	84.4	179	89.9	151	75.8	161	80.9	167	83.9	199	100.0
18 - 21	139	83.2	140	83.8	152	91.0	142	85.0	146	87.4	147	88.0	167	100.0
21 - 24	138	76.2	156	86.1	170	93.9	163	90.0	167	92.2	168	92.8	181	100.0
24 - 27	157	83.0	167	88.3	184	97.3	177	93.6	182	96.2	182	96.2	189	100.0
27 - 30	130	78.7	148	89.6	161	97.5	158	95.7	158	95.7	157	95.1	165	100.0
30 - 33	135	77.1	152	86.8	171	97.7	159	90.8	163	93.1	168	96.0	175	100.0
33 - 36	138	79.7	154	89.0	171	98.8	166	95.9	169	97.6	168	97.1	173	100.0
36 - 39	149	73.0	180	88.2	200	98.0	195	95.5	198	97.0	197	96.5	204	100.0
39 - 42	103	68.2	135	89.4	149	98.6	145	96.0	149	98.6	146	96.6	151	100.0
42 - 45	93	64.5	125	86.8	143	99.3	138	95.8	142	98.6	143	99.3	144	100.0
45 - 48	129	68.2	163	86.2	188	99.4	180	95.2	187	98.9	181	95.7	189	100.0
48 - 51	115	69.2	144	86.7	162	97.5	160	96.3	162	97.5	162	97.5	166	100.0
51 - 54	113	76.3	138	93.2	147	99.3	144	97.2	147	99.3	144	97.2	148	100.0
54 - 57	74	72.5	92	90.1	102	100.0	100	98.0	102	100.0	102	100.0	102	100.0
57 - 60	97	73.4	122	92.4	131	99.2	129	97.7	131	99.2	131	99.2	132	100.0
60 - +	209	70.3	259	87.2	294	98.9	288	96.9	290	97.6	288	96.9	297	100.0
-TOTAL-	2966	79.4	2975	79.6	3153	84.4	2852	76.3	3017	80.7	3022	80.9	3734	100.0

Table 110 shows the present diet eaten by the children in the two nutritional groups. The only significant difference between the two groups was in the use of milk. There were more children in the malnourished group who were receiving milk when compared to the well nourished group (90.7 per cent and 79.2 per cent respectively).

Formula Preparation: It was found that there was no free milk distribution on a large scale in this community; 19 children (0.5 per cent) only were receiving free milk which was used by the children only, not the adults.

Table 111 shows that 89.6 per cent of mothers in the well nourished group were boiling the water for preparing the milk formula, while 81 per cent in the malnourished group were boiling the water for this purpose. This difference was significant at the one per cent level. There was no significant different between Group A and Group B regarding their use of boiling water for drinking purposes.

Table 110

THE PRESENT DIET OF THE CHILD ACCORDING TO THE TWO NUTRITIONAL GROUPS

Nutritional group	A		B		
Present diet	Users	Non users	Users	Non users	P (Chi^2)
Milk	2888 (79.2)	755 (20.7)	59 (90.7)	6 (9.2)	<0.01
Cereals	2906 (79.7)	737 (20.2)	48 (73.8)	17 (26.1)	N.S.
Eggs	2953 (81.1)	688 (18.8)	50 (76.9)	15 (23.0)	N.S.
Fruits and vegetables	3078 (84)	565 (15.5)	52 (80)	13 (20.0)	N.S.
Hommos	2946 (80.8)	696 (19.1)	50 (76.9)	15 (23.0)	N.S.
Meat	2785 (76.4)	857 (23.5)	49 (75.3)	16 (24.6)	N.S.

Figures in parentheses are percentages

Table 111

BOILING WATER FOR DRINKING AND FOR FORMULA PREPARATION IN THE TWO NUTRITIONAL GROUPS

	Group A		Group B			
Boiling water for	Boil	Don't boil	Boil	Don't boil	Chi^2 Value	P (Chi^2)
Drinking	435 (12.1)	3142 (87.8)	6 (9.2)	59 (90.7)	0.515	N.S.
Milk formula	2560 (89.6)	294 (10.3)	43 (81.1)	10 (18.8)	4.077	<0.01

DISCUSSION

2. FEEDING PRACTICES AND WEANING PATTERNS

The confidence of the mother in her ability to breastfeed her baby and her cultural outlook on motherhood and suckling are well known, especially in the rural parts of Jordan where successful breastfeeding is always the rule (ICNND, 1964). The various motivating factors which lead to an almost universal acceptance of breast-feeding as the pattern of choice could be summarised under the following headings:

1. Factors which relate to the convenience of the mother and her ability to provide milk.
2. Factors which relate to the convenience of the infant in health and happiness.
3. Factors which relate to the value system of the community and to cultural concepts attached to breastmilk and its nutritive value.

Harfouche (1965) found that the factors which relate to the convenience of the mother and her ability to provide milk accounted for most of the reasons for breastfeeding. However, mothers in Jamaica (Grantham-McGrogor and Back, 1970; Grantham-McGrogor, Back and Desai, 1972) held the opinion that 'breast is best for babies' but they neither intended nor practiced breastfeeding. This discrepancy between what mothers say and what they do had been observed in rural Chile (Planck; Milanesi, 1973) where mothers believed it was best to breastfeed for a year but few did so.

On the other hand, in other parts of the world it was found that mothers who have the desire to breastfeed their babies proved to be successful breastfeeders (Harfouche, 1965; Newton and Newton, 1950). Also in these studies it was shown that the group of mothers who were willing to breastfeed their babies gave a larger yield of milk and reported less difficulties in suckling than the remaining unwilling group of mothers (Harfouche, 1965). Newton and Newton (1950) have shown the relationship of the 'let down' reflex to the abilitiy to breastfeed. This reflex is subject to psychosomatic disturbance which may ultimately lead to lactation failure. According to this evidence it is believed that motivation is a basic pre-requisite for the practice of breastfeeding. This is why it is important that motivation be integrated with health education during the pre-natal period; the education may fail in modifying maternal attitude after the birth of the infant.

The advantages of breastfeeding were extensively reviewed and have been widely recognised (Jelliffe, 1955; Harfouche, 1973; Miller, 1952; Westropp, 1953; Planck and Milanesi, 1973; Kamel et al, 1969). The indicators of the advantages of human milk are: favourable growth and development in the early months of life; good health and relatively low morbidity and mortality rates as compared with bottle-fed infants living under poor conditions; less digestive trouble; low solute load and emotional satisfaction.

Breastfeeding is also advantageous to the mother if she is adequately nourished and if her body stores are not depleted by a large number of pregnancies and nursing infants. The known maternal advantages are four: a low incidence of breast cancer, baby spacing, emotional satisfaction, simplicity and convenience.

Factors related to the continuing decline in the incidence of breastfeeding could not be due to maternal inadequacy alone, other factors must also be responsible for such variations. Most mothers could nurse their babies for six months or more, if only they were fully convinced of the importance of such an action. Although factors causing lactation failure are not all clearly understood, they are a by-product of modernization, urbanization and affluence, changes in family life, changes in attitudes and value system, the availability of tinned baby food and commercial pressure, medical services and the simplicity of bottle-feeding in industrialized countries.

All these factors in one way or another might be responsible for the 6 per cent of the children in this study who have never had the chance to suck from their mothers.

Weaning Pattern and its Implications: The term 'weaning' has a dual meaning; either it means to accustom a child to the loss of mother's milk, as in the case of gradual weaning, or to detach him from mother's milk (as in the case of abrupt weaning). In addition to the physical aspect - to accustom the child to the loss of mother's milk through the use of other dietary substitutes - the definition also makes provision for detachment from close contact with the mother which is an integral part of the weaning process.

So, accordingly, it was suggested (WHO, 1969) that any substitution of the biological nutrition is weaning. If the weaning starts when the biological nutrition is still sufficient (that is before 6-7 months of age) it is 'unphysiological weaning'.

When it starts after that period, it is a 'physiological weaning'. In both cases, the food used as a substitute for the mother's milk must provide nutrients qualitatively and quantitatively comparable to breast milk.

However, the period of weaning in this study is defined as the total period during which breast milk is being replaced by other foods but is still available to some extent.

The malnourished children in this study had two main problems related to weaning, the first related to early weaning and the second to late weaning.

Before discussing the complications of these two problems, a better understanding of the two weaning patterns (abrupt and gradual) is needed.

Abrupt weaning implies the sudden cessation of breast feeding without previous acquaintance with any other food as a milk substitute. The reasons for this method will be discussed later.

In gradual weaning, the infant was given milk substitutes (liquids, semisolids or regular family food), together with breast milk as complemental and/or supplemental feeds for a period of days to months before the complete cessation of sucking.

To our surprise, gradual weaning was the least practiced type of weaning among the observed children. When gradual weaning was the rule, liquids and semisolids foods, mostly the soft and well cooked parts of the regular family diet were given.

This practice has the following advantages:

1. It supplies the child with foods other than breast milk to meet the nutritional needs of the growing child.

2. It minimizes the emotional problems accompanying late weaning with all their hazards and complications.

3. It is a gradual, reasonable step for the baby to start eating the family diet rather than the semi-solids by the bottle.

4. There is minimum extra cost on the family side to provide the child's share of the family food.

The only disadvantage of this traditional weaning method is the result of insanitary ways of preparing and administering food. It is hoped that the modern Westernized pattern introduced by the health workers will not disrupt this valuable procedure, but on the contrary that this team can adapt this traditional pattern to hygienic standards, so that it continues to prove its value.

The Problems of Early Weaning: Early weaning has been increasing not only as we have seen in this rural community, but also in the developed countries; and always based on the use of cow's milk. Also, even under optimal conditions of general hygiene and care, such artificial feeding involves certain risks as compared with breastfeeding. It is of interest to study the mortality figures for bottle fed infants as compared with the breastfed from an investigation from the United Kingdom as late as 195[illegible] (Robinson, 1951) as shown in Table

Table 112

Relation Between Feeding and Mortality

Feeding	No. of Infants	Mortality/1000
Breastfed	971	10.2
Partly bottle fed	1441	25.7
Bottle fed	854	57.3
Total	3266	29.3

It is quite clear that despite the most optimal conditions with regard to medical supervision and hygiene, early weaned children show higher frequency of certain acute infections and also notable differences in serum biochemistry in comparison with normally weaned children (Mellander, Vahlquist and Mellbin, 1959).

In recent years the etiology and problems of late weaning (after the first year of life) have gained greater importance, due to the growing awareness of protein-energy malnutrition and the implications of late weaning on the nutritional state of the infant. The availability of improved food processing and the manufacture of breast milk substitutes have led many health workers to believe that breast milk substitutes have resolved the problem of early weaning. If this is true for many industrialized countries and among the upper class in developing countries, it certainly is not true of the low income group. In the last decade numerous studies have proven the incidence of malnutrition due to late weaning in various regions of the world, but very little is known about malnutrition in the first and second trimesters of life as a result of early weaning.

During the recent years there has been a shift in the emphasis from the problems of late weaning to those of early weaning (McLaren, 1966, and Hajazi, 1974).

These reports point to the occurrence of severe and mild variants of PEM in early infancy, and do not imply that these nutritional deficiency states have ceased to occur.

A better knowledge of the pattern and etiology of early weaning is not only necessary for the prevention of feeding and nutritional problems, but it is also required for a more comprehensive awareness of the steady decline in the incidence of breastfeeding. The aim of health education, when integrated with pre-natal care is to adapt practices to natural trends, rather than undermine or disrupt these trends whenever they prove to be useful.

There may be many integrated and related factors which have acted separately or combined toward inducing spontaneous drying of breast milk. These will result in early weaning but indirectly affecting the mother. These factors are:

1. The widespread and concentrated commercial propaganda for breast milk substitute.

2. The impatience of the mother and attendant physician, nurse or midwife,

especially in hospital deliveries.

3. Lack in integration of obstetric and paediatric services caused a growing feeling of maternal inadequacy among hospital delivery cases.

4. Changing life pattern and failure of some mothers in this community to observe the practice of breastfeeding and apply it.

Weaning Problems: Weaning is a period of physical and psychological stress for the infant. The success of the weaning process depends on two basic factors: first what food is given, and second, how these foods are given. Problems related to these factors can only be ameliorated through education; adopted feeding advice; improvement in personal hygiene; sanitary and housing conditions. The availability of milk and weaning foods alone are not sufficient for successful weaning; as we have seen among the malnourished group of children in this study, with higher consumption of milk (other than mothers' milk) and use of feeding bottles, weaning practices and general health become worse. The dangers of introducing new tinned foods and feeding bottles to developing countries have been emphasized in recent years especially by Welbourn (1958) and Jelliffe (1955) and (1962).

In Jordan, as it is in many other developing countries, early weaning and early failure in breastfeeding with the concomittant bottle feeding of highly contaminated poor diet have been found instrumental in inducing a change in the pattern of malnutrition among infants and children. Observations in these countries at urban and rural levels, clearly indicated a tendency for the prevalence of malnutrition in the young to shift from the pre-school kwashiorkor to the infant type marasmus. Thus, the risks of early malnutrition with permanent physical and probably mental sequalae were stressed.

Weaning Causes: Weaning causes in this study could be combined under three main groups of factors: maternal, infant and environmental. Maternal factors were few in number but the onset of the next pregnancy comes as a leading one. It was noticed that mother's next pregnancy was the main maternal weaning cause among both nutritional groups and to a bigger extent among the malnourished group.

We examined two findings mentioned in this study, first, the short birth interval which was more common among the malnourished group, and second, the pattern of early weaning which was practiced among more than 50 per cent of the cases. These findings when inter-related would emphasize the need for proper and prolonged birth intervals in order to minimize the dangers and hazards of early weaning.

Mothers in Jordan strongly believe that the breast milk of the pregnant women is not good for the baby. On the contrary they believe that it might be poisonous and harmful and also they might attribute the failure to thrive of the child to the fact that he was breastfed when the mother was in ignorance of her pregnancy. It is quite sad that most of the medical and para-medical personnel agree with these ideas, and they also agree that in such a case the mother should stop breastfeeding suddenly. Instead of having the medical and para-medical people work to change these concepts, they themselves fall under the strong beliefs of the community and start to think that this attitude is true. So, in order to change this concept on a community basis, education should start with the public health workers.

It is our experience that when a public health worker is faced with the question of whether a pregnant woman should continue breastfeeding her child, the following alternatives should be considered:

1. If the mother is healthy and the baby is thriving, then breastfeeding should be continued for a month or two

2. If the mother is healthy and the baby is not gaining proper weight for his age, then breastfeeding should be continued and some supplementary feeds given

3. If both the mother is weak, anaemic or emaciated and the child is not thriving then breastfeeding should be stopped and feeding started with soft parts of the family food.

Milk insufficiency in this study was the second main cause of weaning. This insufficiency state is actually decided by the mother or by a relative. In almost all the cases there was no definite medical opinion based on testing the milk volume by proper weighing of the child. In some instances emotional factors could have been partly responsible for the spontaneous drying up of breast milk, since tension and maladjustment frequently occur during the post-partum period, especially among young primiparae.

Another small group of mothers weaned their children because of actual or anticipated illness (i.e. fear of becoming sick), or because they felt dizzy after nursing.

In some cases babies were weaned as a result of an anatomical factor like a fissure of the nipple or as a result of engorgement of the breast or breast abscess.

The high prevalence of using special weaning devices for the weaning process, together with the high use of abrupt weaning as a weaning pattern, both will have their serious implications and harmful effects on the physical and psychological wellbeing of these babies.

However, the causes of weaning as related to the infants in this community deserve further discussion. Some of the infants were weaned because it was felt by the mother that they were old enough and reached for other food on their own.

Some mothers might have been advised to start a bottle because their mothers friends or fathers, judged they did not have adequate milk on the basis of the child's crying or distention or any other reason. At this time, it is quite difficult to differentiate between milk inadequacy and mere delay in the initiation of lactation. Supplementary bottle feeding prompted by impatience and haste, may have led to complete loss of breast milk due to poor emptying of the breast. It might be that the infant, once introduced to the rubber nipple, may have refused the breast. Patience and reassurance of the mother, and the administration of water or milk, if needed with a cup and spoon instead of the bottle may help in lowering the incidence of artificially fed infants among hospital delivery cases.

Some children were weaned because of sickness or hospitalization for serious illnesses such as gastro-enteritis, pneumonia, meningitis, etc.

Some children were weaned because of severe stomatitis and were unable to suckle and empty the breast, so the milk dried up and they were completely weaned.

Another group of children became very attached to the breast as they grew older and were not keen about taking food other than breast milk. These infants suckled with great frequency, especially at night and the mothers observed that the children grew thinner and were cranky and irritable. These infants probably suffered a great emotional upset during the process of complete weaning. Such attachment to the breast was not encouraged among infants who were weaned completely in early infancy. These observations are inconsistent with those made by Sears et al. (1957) who stated that the amount of emotional upset in the weaning process among American children was related to three aspects of training: the duration of suckling before weaning: the severity of the method used in weaning and the decisiveness of the mother in weaning the infant.

Mixed Feeding: In this community in which breastfeeding should be the rule, the lactation period was shorter than desirable compared to elsewhere (Hijazi, 1969; ICNND, 1964; WHO, 1965). Breast milk is usually the main food of infants and may be completely satisfactory during the first six months of life (WHO, 1965; WHO, 1965). Even in areas where undernutrition and malnutrition are believed to be widespread, records of growth and development of infants up to three months or four months of age are in general satisfactory. Average growth rates at this age seem to differ little from the norms in developed countries (Falkner et al. 1958; Gopalan, 1956; Marsden, 1965).

The position changes when the infants attain the fifth month of life, for they are then outgrowing the breast milk supply and supplementation of diet is essential (Jackson, Hanna and Flynn, 1962). During this phase there is abundant evidence of faltering growth and impairment of health. Infants are particularly susceptible to respiratory and gastro-intestinal infections, because of the combined effect of poor hygiene and dietary inadequacy (Gopalan, 1956; Gordon 1964; Scrimshaw, Taylor and Gordon, 1959 and Yankauer and Ordway, 1964). Mortality in the age group one to four years is twenty to fifty times higher in the developing than in the developed countries and has a special meaning as an index of malnutrition in this community (Wills and Waterlow, 1958 and McGregor, Billeweiz and Thomson, 1961).

So, due to the importance of supplementation and the role it plays in affecting growth, morbidity and mortality rates of infants and young children in this community, additional foods were given special consideration.

In the results on the feeding practices detailed information was given on the first solid food given and also some food items given in different age periods.

This part of the discussion is intended to give some further details on some common and important food items in this community.

Water: In this community water is very important for nutrition. It was our concern to inquire whether the given water was boiled or not, and as we expected, 86.3 per cent of the children were found drinking unboiled water. Here, the public health worker is faced with a difficult choice. Water if not boiled is almost always contaminated, but without water the insensible water loss through sweat during the hot summer months may lead to marked dehydration, especially among artificially fed infants. A slight rise in temperature without any apparent cause might be corrected by advising the mother to increase the amount of water which was given to the child. Many physicians unnecessarily prescribe antibiotics on the assumption that this is a fever of unknown origin (Harfouche, 1965). When advising the water administration two other corrective measures should be emphasized to the mothers: first, boiling the water and second, administering the water by a cup and spoon.

Beverages and Soft Drinks: Tea in Jordan is considered by most people as a food and as the prevalence of weaning attained its peak, tea was gradually used as a milk substitute. As the age of the infant increased, more tea was consumed. This replacement is a very common dietary characteristic of Jordanian children in the weaning period. Tea is given either alone or with bread, cake or biscuits. However, coffee is not a milk substitute in this community. Coffee here is served black and bitter.

In recent years a wide variety of soft drinks has entered the local market. Soft drinks are competing with milk and tea, especially among those people where the low income of the families does not permit infants and children to have both milk and soft drinks at the same time.

Cereals: Cereals in this community, as it is all over Jordan, had a high frequency of consumption, mainly in the form of bread, kaak and biscuits. This observation is in agreement with the dietary habits of Jordan population in general and of the low income group in particular.

Rice had the greatest rate of consumption. It is prepared as rice water, soup, pudding or with yogurt.

'Cerelac' is a well known special baby cereal made by Nestle. It is widely used in this rural community and it is always available on the shelves of the shops in the villages. During the last few years, there has been a continuous rise in its price, but it is still popular despite being so expensive.

The use of special canned cereals and other baby foods may be taken as an index of the degree of exposure to the Western way of infant feeding and of relative change from the traditional pattern.

Fruits and Vegetables: These had a high frequency of consumption by the children in this study. Citrus fruits, bananas and green, leafy vegetables are almost always available in the market at a relatively low cost.

Meat, Chicken and Fish: These had a low frequency among the dietary items consumed. Meat in Jordan is an expensive food item, and even if it is within the purchasing power of the family its distribution in the big families may mean that it does not reach infants and young children. Also, meat or chicken are cooked in a

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In recent years, child health workers in the developing countries have emphasised the nutritional and diarrhoeal dangers of ill advised bottle feeding. Welbourn (1955) speaks of bottle feeding as a 'problem of modern civilisation'. Jelliffe (1962) includes the disorders of improper bottle feeding under the diseases of 'semi-sophistication' which are emerging as increasingly important entities in the disease patterns of economically developing countries. Studies conducted elsewhere (Vorhoestraete and Puffer, 1958) support this view and give evidence of a higher incidence of diarrhoeal disease among artificially fed infants as a result of poor sanitary measures and improper bottle feeding.

The shortage of cow's milk and the difficulties in having proper storage facilities have made the country's imports of powdered milk increase steadily during the last few years. The names and composition of these milk preparations are a source of confusion to the general practitioner and the paediatrician. There is also the dilemma of choice for the parents who are under the bombardment by propaganda for these brands of milk. To them the best brand is the one most repeatedly announced on television and the radio, regardless of its nutritive value, content or even price. Of the available varieties 32 brands were used and, of these, NIDO made by Nestle had the highest freauency. Several mothers changed the brand frequently: the change was determined by the purchasing power of the family, the advice received, suitability for the infant as judged by the mother and the availability of the milk brand on the market.

way to suit adults and not infants.

Fish in Jordan is not widely consumed due to its scarcity; moreover frozen fish is difficult to store and transport.

Eggs: Eggs have a high frequency of consumption. They are both imported and locally produced and egg production is growing rapidly. Many villagers have their own chickens. The nutritional value of eggs and their importance are appreciated by almost all the villagers and there are no cultural barriers or taboos against their use. Fresh village eggs are believed to be more nutritious than those from large farms or imported eggs, especially as they have darker yellow yolks.

Bottle Feeding and Formula Preparation: In this study we were able to identify two significant findings regarding bottle feeding and formula preparation. The first was that the consumption of milk other than mothers' milk among the malnourished group was significantly higher than the consumption of other than breast milk among the well nourished group. This nutritious valuable source of nutrients is changed into a 'killing instrument' in the bottles of these villagers in Jordan. The second finding which supports this first is that the number of those who boil the water for mixing a milk formula was significantly higher among the well nourished group.

In conclusion, more of the malnourished than the well nourished children were given other than breast milk and were given milk prepared with unboiled water. In the well nourished group, if other than breast milk was given, it was prepared with clean water.

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3. TESTING THE EFFECT OF FEEDING PRACTICE ON THE CHILDREN'S MEASUREMENTS

RESULTS

The analysis of growth progress in relation to the feeding practice was made by studying the different aspects of growth as determined by the following indices: weight, height, arm circumference and the combined triceps and subscapular skinfold thicknesses, on the following feeding practices:

1. Completely breast fed children
2. Partially breast fed children
3. Completely weaned children

The growth indices of these children for every feeding practice were determined for males and females separately and for the two sexes combined. The means, ranges, standard deviations, coefficient of variation and the standard error for each index were calculated. All the tables related to this part are in the appendix; however, the effect of feeding practice on weights, heights, arm circumference and the combined triceps and subscapular skinfold thickness in the age per interval 0-24 months are shown in the following tables - 113 to 117.

Graphs 39 to 40 show the weight curves among these children.

The Weight Pattern:

Table 113 shows the results of testing the effect of feeding pattern on the childrens' weights.

Table 113

TESTING THE EFFECT OF FEEDING PATTERN ON THE CHILDRENS' WEIGHTS

		(1)		(2)		(3)		T - Values						F - Value		
		Comp Weaned		Par Breast		Com Breast		(1) x (2)		(2) x (3)		(1) x (3)		Degree		Sig.
Age group	Un-known	N1	Mean	N2	Mean	N3	Mean	Value	Sig.	Value	Sig.	Value	Sig.	of-fr.	Value	Level
0 - 3	0	49	4.760	49	4.806	70	4.431	0.212	N.S.	2.147	5%	1.765	N.S.	2, 165	2.561	N.S.
3 - 6	0	88	6.252	52	6.114	36	6.418	0.621	N.S.	1.280	N.S.	0.697	N.S.	2, 173	0.680	N.S.
6 - 9	3	99	7.460	51	7.797	59	7.717	1.553	N.S.	0.385	N.S.	1.296	N.S.	2, 206	1.641	N.S.
9 - 12	1	109	8.262	50	8.404	36	8.542	0.717	N.S.	0.520	N.S.	1.270	N.S.	2, 192	0.852	N.S.
12 - 15	0	134	8.920	35	9.025	36	8.496	0.418	N.S.	1.745	N.S.	1.686	N.S.	2, 202	1.771	N.S.
15 - 18	1	161	9.332	20	9.346	15	9.907	0.043	N.S.	1.452	N.S.	1.582	N.S.	2, 193	1.287	N.S.
18 - 21	1	140	10.157	14	10.578	7	9.244	1.081	N.S.	2.447	5%	1.673	N.S.	2, 158	2.160	N.S.
21 - 24	0	172	10.571	4	10.287	4	10.212	0.383	N.S.	0.070	N.S.	0.482	N.S.	2, 177	0.185	N.S.

N.S. = Not significant at the 5 per cent level

At 0-3 months: there was no difference in the mean weights of the completely weaned and the partially breastfed children.

However, the partially breastfed childrens' mean weights at this age were significantly higher than the completely breastfed children ($P < 0.05$).

At 3-18 months: there were no significant differences in the mean weight measurements in this age interval among the three groups.

At 18-21 months: the mean weights of the partially breastfed children were significantly higher than the mean weights of the completely breastfed children ($P < 0.05$).

At 21-24 months: there were no significant differences in the mean values of the weights in the three groups. However, the completely weaned had the highest mean weight value.

<u>The Height Pattern:</u> Table 114 shows the results of testing the effect of feeding practice on childrens' heights.

At 0-3 months: the partially breastfed children had the highest significant mean height measurements among the three feeding practices ($P < 0.01$).

Also, when testing the effect of feeding patterns on the mean heights of the partially breastfed and the completely breastfed children, the partially breastfed mean

Table 114

TESTING THE EFFECT OF FEEDING PATTERN ON THE CHILDRENS' HEIGHTS

			(1)		(2)		(3)	T - Values						F - Value		
								(1) x (2)		(2) x (3)		(1) x (3)				
Age group	Un-known	Comp N1	Weaned Mean	Par N2	Breast Mean	Com N3	Breast Mean	Value	Sig.	Value	Sig.	Value	Sig.	Degree of-fr.	Value	Sig. Level
0 - 3	0	49	56.206	49	56.924	70	54.606	0.845	N.S.	3.580	0.001	2.129	5%	2, 165	5.569	0.01
3 - 6	0	88	62.350	52	61.646	36	62.372	1.019	N.S.	0.924	N.S.	0.028	N.S.	2,173	0.631	N.S.
6 - 9	3	99	66.921	50	66.401	60	66.458	0.732	N.S.	0.090	N.S.	0.676	N.S.	2, 206	0.404	N.S.
9 - 12	0	109	69.837	50	69.839	37	70.072	0.004	N.S.	0.316	N.S.	0.440	N.S.	2, 193	0.090	N.S.
12 - 15	3	132	73.265	35	72.982	35	71.797	0.357	N.S.	1.521	N.S.	1.802	N.S.	2, 199	1.785	N.S.
15 - 18	1	162	75.310	20	75.064	14	76.849	0.230	N.S.	1.590	N.S.	1.225	N.S.	2, 193	0.849	N.S.
18 - 21	1	140	77.746	14	79.049	7	75.657	0.775	N.S.	2.231	5%	0.884	N.S.	2,158	0.773	N.S.
21 - 24	4	168	80.218	4	79.699	4	73.925	0.240	N.S.	3.285	5%	2.924	0.01	2, 173	4.333	0.01

N.S. = Not significant at the 5 per cent level

height measurements were significantly higher than the completely breastfed group ($P < 0.001$), but when comparing the completely weaned and the completely breastfed, the latter group had significantly higher mean heights ($P < 0.05$).

At 3-18 months: there were no significant differences in the mean heights of the three feeding practices.

At 18-21 months: at this age group it was shown that the partially breastfed children had a significantly higher mean height value ($P < 0.05$) than the completely breastfed children.

At 21-24 months: the height differences in this age group showed some changes similar to those in the weight measurements values. The completely weaned children had the highest significant mean height ($P < 0.01$). When comparing the completely breastfed mean heights with the partially breastfed mean height, the latter group were significantly higher ($P < 0.05$). Also, when comparing the mean height values of the completely breastfed and the mean height values of the completely weaned, the latter group's mean heights were significantly higher ($P < 0.01$).

<u>The Arm Circumference Pattern:</u> Table 115 shows the results of testing the effect of feeding practice on the childrens' mean arm circumference measurements.

Table 115

TESTING THE EFFECT OF FEEDING PATTERN ON THE CHILDRENS' ARM CIRCUMFERENCES

			(1)		(2)		(3)	T - Values						F - Value		
								(1) x (2)		(2) x (3)		(1) x (3)				
Age group	Un-known	Comp N1	Weaned Mean	Par Breast N2	Mean	Com Breast N3	Mean	Value	Sig.	Value	Sig.	Value	Sig.	Degree of-fr.	Value	Sig. Level
0 - 3	1	49	11.540	48	11.735	70	11.624	0.678	N.S.	0.409	N.S.	0.306	N.S.	2, 164	0.221	N.S.
3 - 6	0	88	12.648	52	12.726	36	12.747	0.312	N.S.	0.080	N.S.	0.363	N.S.	2, 173	0.093	N.S.
6 - 9	0	101	13.495	51	13.552	60	13.409	0.252	N.S.	0.621	N.S.	0.410	N.S.	2, 209	0.178	N.S.
9 - 12	2	108	13.780	49	13.875	37	13.837	0.454	N.S.	0.172	N.S.	0.234	N.S.	2, 191	0.116	N.S.
12 - 15	1	134	13.752	35	13.799	35	13.979	0.178	N.S.	0.560	N.S.	0.859	N.S.	2, 201	0.373	N.S.
15 - 18	1	161	13.658	20	13.794	15	14.473	0.483	N.S.	1.635	N.S.	2.560	5%	2, 193	3.273	5%
18 - 21	0	141	14.139	14	14.199	7	13.699	0.184	N.S.	0.891	N.S.	0.952	N.S.	2, 159	0.490	N.S.
21 - 24	0	172	14.228	4	14.125	4	13.799	0.183	N.S.	0.430	N.S.	0.765	N.S.	2, 177	0.307	N.S.

N.S. = not significant at the 5 per cent level

There was no difference in the mean values of the arm circumference between the three groups of feeding practices in almost all the age groups, except in the age intervals 15-18 months, where it was found that the mean arm circumference of the completely weaned children was significantly higher than the completely breastfed children ($P < 0.05$). In this age group also, the mean arm circumference of the partially breastfed children was higher than the mean arm circumference of the partially breastfed, but not to a significant level.

The skinfold thickness: Table 116 shows the results of testing the effect of feeding pattern on the childrens' mean combined skinfold thickness (triceps and subscapular).

At 0-3 months: the mean value of the combined triceps and subscapular skinfold thickness of the partially breastfed children was significantly higher than the mean value of the completely breastfed children ($P < 0.05$).

At 12-15 months: the mean value of the combined skinfold thickness of the completely weaned children was significantly higher than the mean value of partially breastfed children ($P < 0.05$).

Table 116

TESTING THE EFFECT OF FEEDING PATTERN ON THE CHILDREN'S

SKINFOLD THICKNESS

		(1)		(2)		(3)		T - Values						F - Value		
Age Group	Un-known	Comp Weaned N1	Mean	Par Breast N2	Mean	Com Breast N3	Mean	(1) x (2) Value	Sig.	(2) x (3) Value	Sig.	(1) x (3) Value	Sig.	Degree of-fr.	Value	Sig. Level
0 - 3	2	49	10.783	48	11.864	69	10.682	1.679	N.S.	2.186	5%	0.187	N.S.	2, 162	2.538	N.S.
3 - 6	0	88	12.711	52	12.082	36	12.172	1.183	N.S.	0.157	N.S.	0.920	N.S.	2, 173	0.918	N.S.
6 - 9	1	101	12.997	51	12.494	59	13.077	0.917	N.S.	1.098	N.S.	0.149	N.S.	2, 208	0.577	N.S.
9 - 12	0	109	12.364	50	12.115	37	12.289	0.591	N.S.	0.402	N.S.	0.145	N.S.	2,193	0.174	N.S.
12 - 15	6	129	11.337	35	10.925	35	11.711	1.976	5%	1.505	N.S.	0.264	N.S.	2,196	1.980	N.S.
15 - 18	0	162	11.511	20	11.064	15	11.373	0.783	N.S.	0.370	N.S.	0.209	N.S.	2,194	0.312	N.S.
18 - 21	1	141	12.189	14	11.614	6	11.099	0.842	N.S.	0.563	N.S.	1.073	N.S.	2,158	0.900	N.S.
21 - 24	1	171	11.953	4	11.524	4	11.350	0.362	N.S.	0.115	N.S.	0.510	N.S.	2, 176	0.192	N.S.

N.S. = Not significant at the 5 per cent level

Table 117

TESTING THE EFFECT OF THREE TYPES OF FEEDING PATTERNS; (COMPLETE WEANING (1), PARTIAL BREAST FEEDING (2) AND COMPLETE BREAST FEEDING (3)), ON THE CHILDREN'S MEAN VALUES OF FOUR MAIN MEASUREMENTS ACCORDING TO DIFFERENT AGE GROUPS

	Weight T - test				Height T - test				Arm circumference T - test				Skinfold thickness (triceps and subscapular) T - test			
Age (months)	1 x 2	2 x 3	1 x 3	F.Test P	1 x 2	2 x 3	1 x 3	F.Test P	1 x 2	2 x 3	1 x 3	F.Test P	1 x 2	2 x 3	1 x 3	F.Test P
0 - 3		<0.05				<0.001	<0.05	<0.01						<0.05		
3 - 6																
6 - 9																
9 - 12																
12 - 15													<0.05			
15 - 18											<0.05	<0.05				
18 - 21		<0.05				<0.05										
21 - 24						<0.05	<0.01	<0.01								

Note: Underlined figures correspond to the larger mean value of that measurement

Blanks indicate not significant relations at the 5 per cent level

MALES

Figure 39: Mean weights for the three groups of feeding practices, males, 0 - 24 months

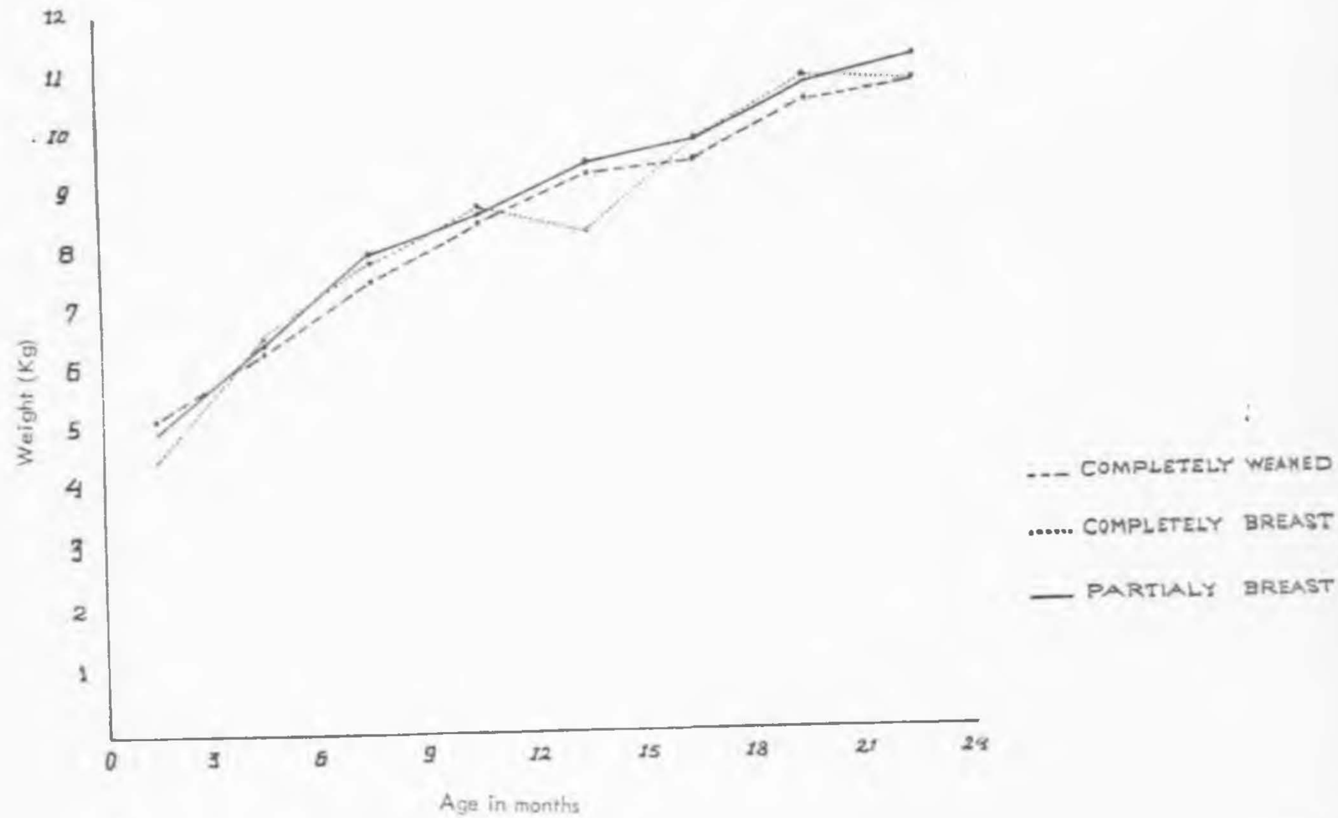


Figure 39 - Mean weights for the three groups of feeding practices, males, 0 – 24 months

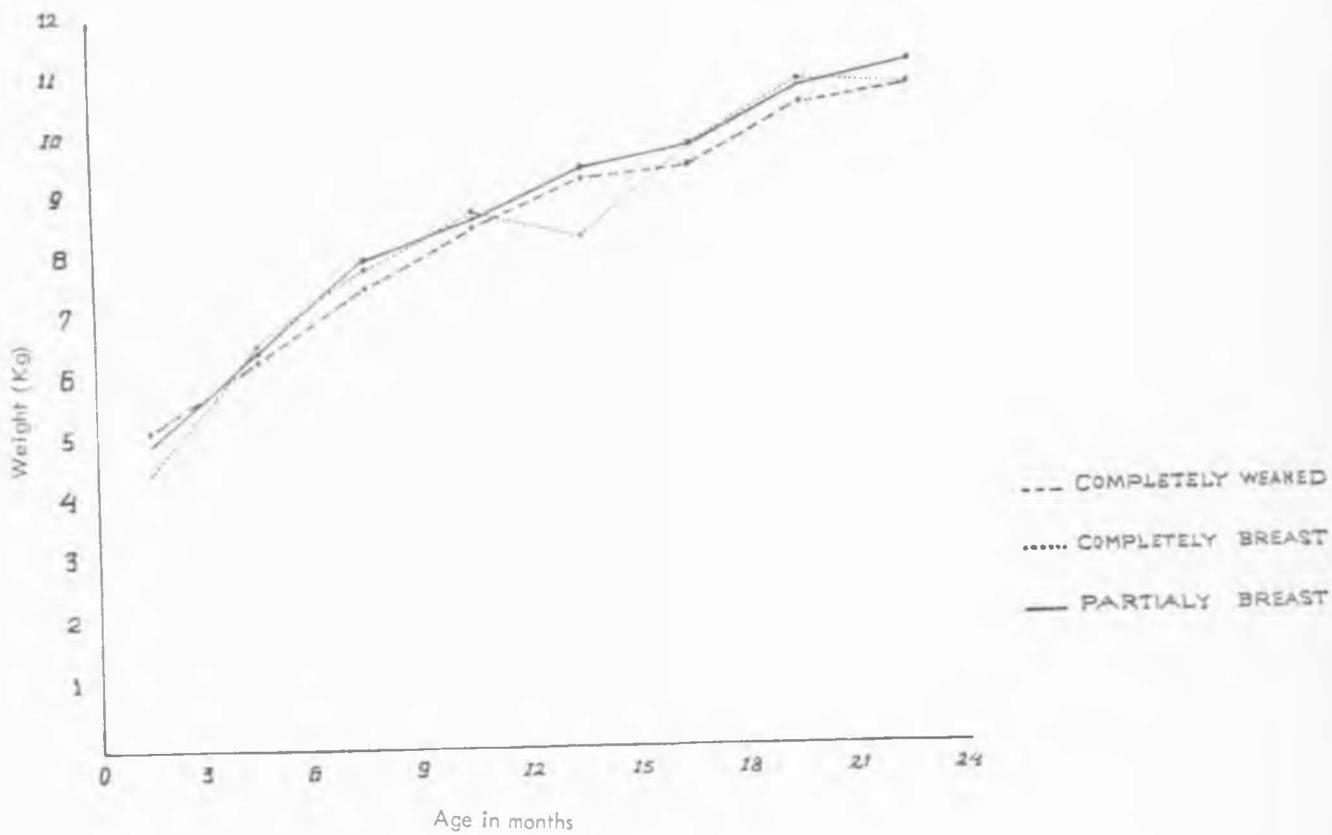


Figure 40 : Mean weights for the three groups of feeding practices, females, 0 - 24 months

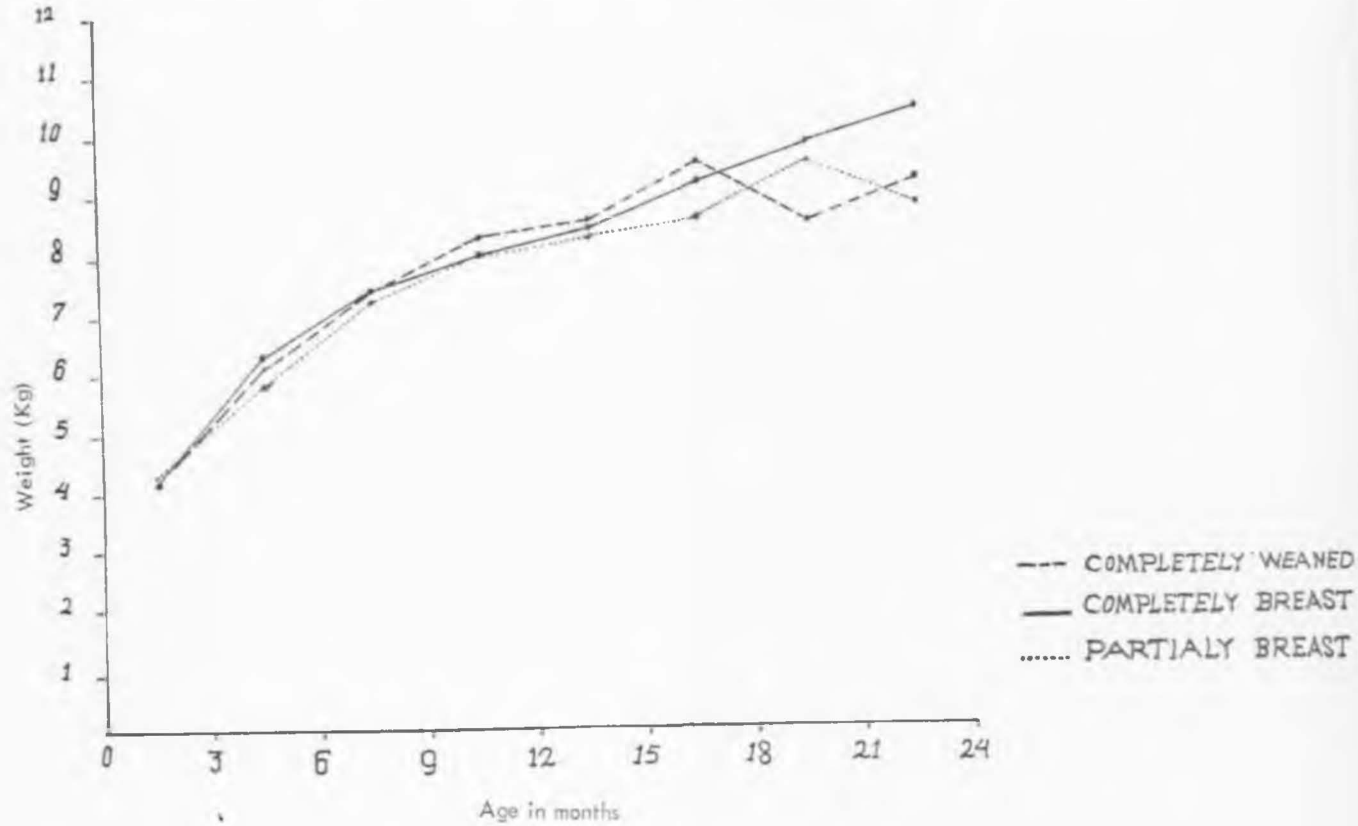
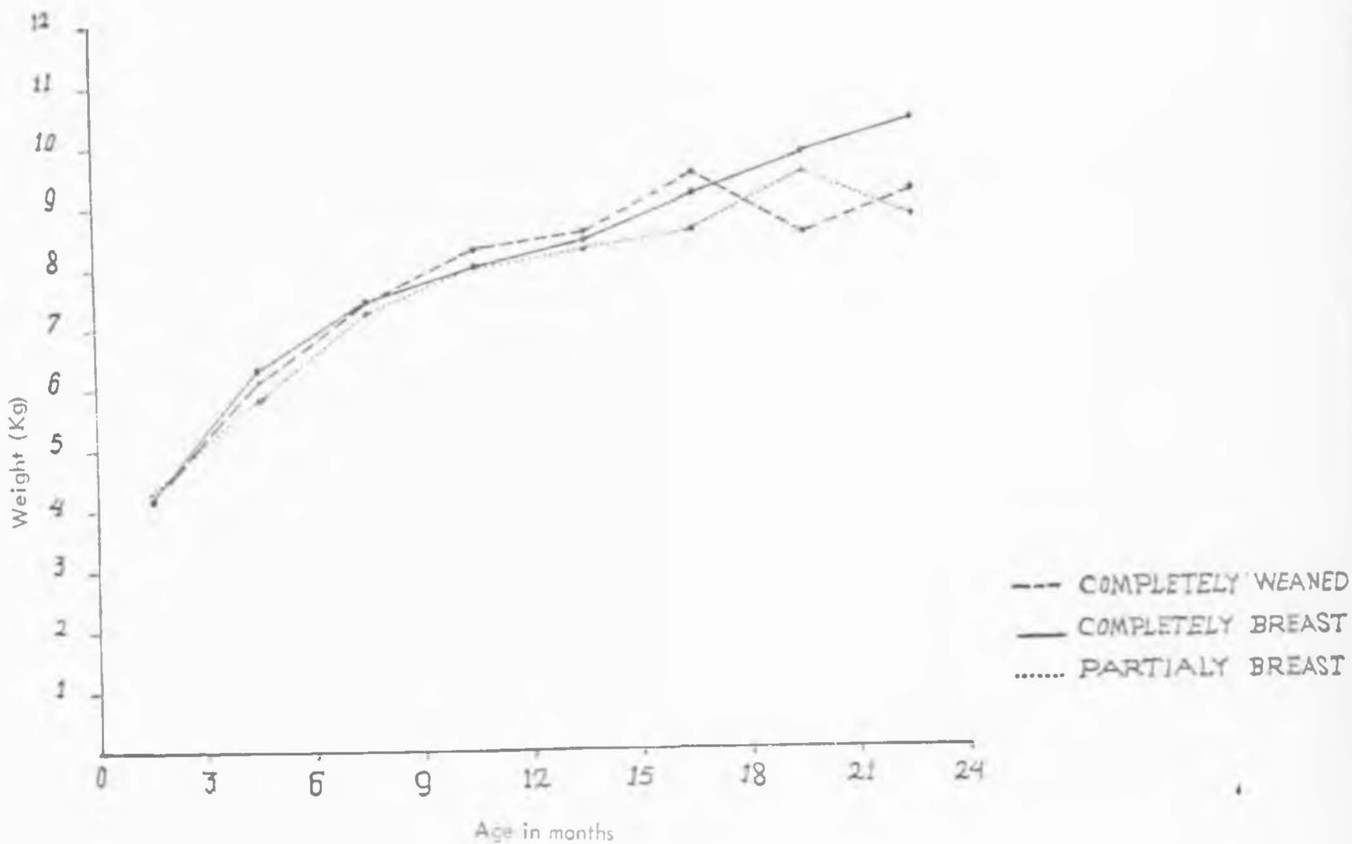


Figure 40 : Mean weights for the three groups of feeding practices, females, 0 - 24 months



4. TESTING THE EFFECT OF FEEDING PRACTICE ON THE CHILDREN'S GROWTH – DISCUSSION

When looking at the effect of the three different feeding patterns on the mean values of weights, heights, arm circumference and skinfold thickness (combined triceps and subscapular) one finds significant differences in the mean values of two major age groups, namely 0–3 months and 12–24 months. These are actually the most sensitive ages for any changes in the feeding pattern.

In the age group 0–3 months there was an almost consistent finding which shows that the partially breastfed children had higher mean values in terms of their mean weights, heights and skinfold thickness.

This finding was better illustrated in the age group 12–24 months. In this age group breast milk only was not sufficient to meet the needs of the children so both the partially breastfed and the completely weaned children did better than the breastfed except in the age group 12–15 months where the mean value of the arm circumference of the completely breastfed children was higher.

The effect of supplementary feeding and the addition of solids even at an early age was also shown to be beneficial on the growth of the Jordanian children (Jordan Nutrition Survey, 1964).

It was recommended in that survey that further studies on the problem of supplementary feeding should take place and hence such a policy to be included in our nutrition health education.

The main solids to be encouraged to supplement the mother's breast would be cereals and legumes which are almost always available at reasonable prices within the reach of most people. These foods do not need special cooling or refrigeration, and they can be cooked simply, i.e. parboiling of lentils, chickpeas, the cereals made into bread and other flour preparations.

While we see the partially breastfed thriving better in terms of their weights, heights, and skinfold thickness, especially during the first three months of infancy, we should always remember that it is also at this age that the hazards of early obesity are greatest. It is then that the irreversible two processes of obesity namely, cell hypertrophy and cell ~~hyperplasma~~ occur.
hyperplasia

It is in such communities that public health workers are faced with two contradictory points:

1. In this community there is a transitional change from the state of severe malnutrition which used to exist ten years ago, into a state of mild to moderate and even to normal state of nutrition nowadays. If we are really concerned with the eradication of all forms of malnutrition, especially the modern form of malnutrition (i.e. obesity) then we

should carry out a broad and long acting programme from now on. This programme will be as follows:

1. Breast feeding to be continued until the age of 1-1½ years.

2. Cereals and legumes in moderate quantities to be added from the age of three months together with breast feeding.

3. Avoid any cows milk before the age of six months unless it is the only milk available.

4. Look out for early signs of under nutrition as well as for signs of overweight.

a. GENERAL VARIABLES RELATED TO THE FAMILY CONDITIONS

Table 118 shows the percent distribution of household size in the two nutritional groups. The mean household size for the well nourished children was 8.5 persons per household and for the malnourished group it was 9 persons per household. The differences between the groups were not significant statistically at the 5 per cent level.

Table 119 shows the number of children less than 15 years old in the families of Groups A and B. The differences were again not significant. Most families had between three and six children below 15 years old.

Table 120 shows the childs' birth rank according to the degree of nutrition; about 40 per cent of the well nourished children and 35 per cent of the malnourished children were from the brith rank 1 to 3. 16.8 per cent of the malnourished children were of birth rank more than 8, compared with 10.7 per cent of the well nourished. The significance test shows that these differences in the distribution of birth rank are significant, so that evidently the later born child in a family is more likely to be malnourished.

The fathers in this study (Table 121) are of two main origins: Jordanians 55.7 per cent and Palestinians 44.3 per cent; there are no significant differences in the state of nutrition between the two groups.

Table 118

HOUSEHOLD SIZE ACCORDING TO THE TWO NUTRITIONAL GROUPS

Household size	Well nourished Group A	Malnourished Group B	Total
1 - 3	0.10	0	0.1
4 - 6	24.7	21.5	24.7
7 - 9	41.2	41.5	41.3
10 - 12	27.0	32.30	27.2
13 - 15	5.02	4.6	5.0
16+	1.7	0	1.7
Mean	8.5	9	

Chi^2 value 2.145; P : N.S.

Values are percents of each group

Table 119

NUMBER OF CHILDREN LESS THAN 15 YEARS
IN THE TWO NUTRITIONAL GROUPS

Number of children Less than 15 years	Well nourished Group A	Malnourished Group B	Total
1 - 2	13.48	12.30	13.5
3 - 4	31.63	33.84	31.7
5 - 6	32.61	32.30	32.6
7 - 8	18.39	21.53	18.5
9 - 10	2.85	0	2.8
11 - 12	0.98	0	1.0

Chi^2 value 3.024; P : N.S.

Values are percents of each group

Table 120

CHILD'S AGE POSITION ACCORDING TO THE DEGREE OF NUTRITION

Child's age position	Well nourished Group A	Malnourished Group B	Total
1	12.6	7.6	12.5
2	13.7	16.9	13.8
3	14.8	10.7	14.7
4	13.5	21.5	13.7
5	13.1	7.6	13.1
6	12.1	10.7	12.1
7	8.9	7.6	8.9
8	5.8	7.6	5.9
9	2.8	4.6	2.9
10+	2.1	4.6	2.3
Mean	4.3	4.6	

Chi^2 value 16.957; $P < 0.05$

Values are percents of each group

Table 121

ORIGIN OF THE FATHER IN THE
TWO NUTRITIONAL GROUPS

Origin	Well nourished Group A	Malnourished Group B	Total
Jordanian	55.7	49.2	55.6
Palestinian	44.2	50.7	44.4

Chi^2 value 1.101; P : N.S.

Values are percents of each group

b. MARITAL RELATIONS

It was shown in the general results that almost all the mothers in this study were married. The number of widowed, divorced, unmarried or separated mothers was almost negligble.

The marital relations in this section are dealt with under the following questions: firstly, the effect of polygamy on the nutritional status was investigated and, secondly, the degree of kinship of the parents and its relation to the nutritional status of the child was also studied.

Table 122 shows that there were more men in the well nourished group who were married to two wives than in the malnourished group. This difference was significant at the 5 per cent level, which indicates that children from polygamous families were at less risk from malnutrition.

Table 123 shows that malnourished children are more likely to come from familes with closely related parents ($P < 0.01$).

The significance and interpretation of these findings will be discussed later.

Table 122

THE NUMBER OF WIVES IN THE TWO NUTRITIONAL GROUPS

Number of wives	Well nourished Group A	Malnourished Group B	Total
One	84.6	96.9	84.8
Two	13.9	3.0	13.8
Three	1.1	0.0	4.1
Four	0.2	0.0	0.3

Chi^2 value 7.557; $P < 0.05$

Values are percents of each group

Table 123

DEGREE OF KINSHIP OF PARENTS ACCORDING TO THE NUTRITIONAL DEGREE

Degree of kinship of parents	Well nourished Group A	Malnourished Group B	Total
First degree cousins	39.2	55.3	39.6
2nd & 3rd degree cousins	20.8	16.9	20.8
Distantly related or not related	39.8	27.6	39.6

Chi^2 value 7.021 $P < 0.01$

Values are percents of each group

Discussion of Marital Relations: It was mentioned in the section on the general results that the incidence of consanguinous marriage in Jordan is more than that reported in a few other studies; Shull (1958) in Japan reported a percentage of 2.1 to 14.3 for first cousin marriages.

It is the custom among people of these Jordanian villages for a man to marry the daughter of his father's brother. This is to be considered a full right and it is his moral obligation to do so, unless he feels that he does not want to.

If a girl is in the final stage of getting married to another man, her uncle's son has the right to bring her back and marry her. Also, if a girl wants to get married to a man, her uncle's son of a marriageable age should waive his rights, which he usually does withoutdifficulty when asked.

There are many factors which favour the continuation of this custom. There seem to be strong social and economic reasons connected with dowry and bride price and with the close inter-family loyalties.

It is expected that the first cousin marriage may tend to decline with the advent of better communications with the outside world, and, therefore, those who marry their first cousins may be those who do not go outside their own villages. However, among the distantly related or unrelated marriages, marriage to a woman from outside the village is comparatively uncommon.

Due to religous and family beliefs one can be certain that sexual morals are regulated by a strict and severe code so that illegitimacy and marital infidelity are virtually unknown in this community.

Polygamous Marriage and Nutritional Status: It was surprising to find that children of polygamous marriages were thriving better than those of a monogamous marriage. The health, social and economic aspects of polygamy in Jordan have, to our knowledge not been studied. It is known that most of those who have more than one wife must be financially well to do in order to support the responsibilities of having two wives, two houses and many children. They are usually the head of the villages or big land or business owners. On the other hand, the care given to the children of different women is almost the same, although it is expected that the two women will try to compete with each other for better child care and feeding. The last wife (usually the second) of a polygamous marriage is known in Jordan to be the favoured one and the first wife the least cared for.

It should also be emphasised that polygamy in the city environment carries a completely different meaning and might lead to serious health problems. Garn (1963) found that polygamy was associated with a high incidence of malnutrition. The explanation for that was found in the conflicts arising in a rapidly expanding city. When such a family adopts an urban way of life, the extended family unit is usually forced to split intosmaller units to suit the accommodation available. Their lodging may be scattered around the town, and the husband is able to give his wives and children only irregular attention. The wives' desires and chances to work together for the good of the family are lost and they may be no longer a financial asset, but rather a financial liability to their husband.

It has also been observed (Morley, Kicknell and Woodland, 1968) that in such villages as Imesi in Nigeria monogamy was more frequent in families with no inherited place in the village society and no land to farm so that they formed the more unsettled part of the community with no stable financial resources. In that region polygamy was associated with stability of the family, ownership of land and a higher standard of child care, the husband accepting the responsibility for his wives and children who in turn helped him by farming and trading. The results obtained at Imesi indicated that polygamy was not associated with a particular pattern of nutrition in the child and monogamy was common among families with well nourished children.

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c. ECONOMIC STATUS

The economic status of the families of these children was studied through the investigation of the following:

1. Type of father's job (temporary or permanent)
2. Occupation of the father
3. Income of the father
4. Land ownership

Table 124 shows that the majority of all the fathers had a permanent type of job and especially the fathers of the well nourished children.

The occupation of the fathers (Table 125) was based mainly on the Department of General Statistics Classification System. Almost half the fathers were either agricultural or non-agricultural labourers; an expected finding in such a rural community. Because these villages are not far from Amman, they had a fairly large number of men working either as civil servants or employees in the private sector in Amman. The third big section of occupations was military and police services; this is also another field of occupation which is mainly filled by villagers and bedouins.

Table 126 shows that most of the fathers earn 20-40 J.D. per month in cash an income which can hardly nowadays meet the most basic needs of these large families.

Because there was a continuous rapid increase in the price of land, especially during the last few years, it was felt that land ownership apart from its agricultural value might be an important economic index. In this community however, about 20 per cent of the fathers possess a piece of land, even though big land ownership is not common in Jordan, (Table 127). There was no difference between the two groups.

Table 124

TYPE OF FATHER'S JOB IN THE TWO NUTRITIONAL GROUPS

Type of father's job	Well nourished Group A	Malnourished Group B	Total
Permanent	84.0	77.7	83.9
Temporary	15.9	22.2	16.1

Chi^2 value 1.772, P. N.S.

Figures are percents of each group

Table 125

OCCUPATION OF FATHERS IN THE TWO NUTRITIONAL GROUPS

Occupation of father	Well nourished Group A	Malnourished Group B
Employee	12.87	10.76
Military, police	19.98	18.46
Retired	1.20	-
Labourer	40.80	47.69
Unemployed	4.77	3.07
Driver	9.61	13.84
Self employed	6.39	1.53
Teacher	2.63	1.53
Dead	1.70	1.53

Chi^2 value 4.809 P:N.S.

Figures are percents of each group

Table 126

FATHER'S CASH INCOME IN J.D.s PER MONTH

Father's income J.D.	Well nourished Group A	Malnourished Group B	Total
Less than 20	11.5	15.7	11.6
20 - 40	69.6	64.9	69.6
More than 40	18.7	19.2	18.8

Chi^2 value 1.059, P N.S.

Figures are percents of each group

Table 127

LAND OWNERSHIP IN THE TWO NUTRITIONAL GROUPS

	Well nourished Group A	Malnourished Group B	Total
Percent possess land	22.2	21.8	22.3
Percent do not possess land	77.7	78.1	77.7

Chi^2 0.006, P : N.S.

Values are percents of each group

Discussion of the Economic Status: The income of fathers in this study fits in with the general range in the country as a whole. This is actually a low-middle class income.

Because of the rapidly changing economic and social patterns in this community this income is not enough to cover the very important daily needs; many of the families here might have other incomes from either agricultural or non-agricultural jobs; also, it is becoming acceptable for women in this area to work and share in the financial responsibilities of men although this is not a common practice.

Another feature of the economic development in these villages results from the influx of many employees who work in Amman in either governmental or non-governmental agencies, who left the city and came back to live in the village.

Many people are also moving from the expensive capital back to their own properties in these villages; this movement will increase if electricity and water are available.

d. HOUSING CONDITIONS

Housing conditions and amenities were studied in the following aspects:

1. Ownership of the house: Table 128 shows that about two thirds of all the families live in their own houses. It is worth mentioning that when we investigated the rental payments for rented houses we found them too small to affect the overall economic status of the family. Perhaps for this reason there were not significant differences between the well nourished and malnourished groups.

2. Number of rooms: Table 129 shows that most of the people live in one to two roomed houses. Again, there is not much difference between the two nutritional groups.

3. Cooking facilities: Table 130 shows that kerosene was widely used for cooking purposes; butane gas was next most popular and a few families were using a woodfire for cooking. There were no significant differences between the groups.

It was expected that the recent introduction and use of butane gas as an easy and rapid way of boiling the water for preparing the milk formula might have some significant effect on the prevalence of diarrhoeal diseases and hence in reducing the prevalence of malnutrition. Probably this, which is only one of many aspects in the preparation of a hygienic formula ready for infant use, was not sufficient by itself, and there are other problems probably related to storage. Thus the availability of sterilization by boiling is not by itself enough to ensure a hygienic infant milk supply.

4. Source of water: Table 131 shows that in general the well nourished group used relatively safer sources of water Because water and health problems related to water are very important, they will be discussed in more detail below.

Table 128

HOUSE OWNERSHIP ACCORDING TO THE DEGREES OF NUTRITION

House ownership	Well nourished Group A	Malnourished Group B	Total
Owned	68.0	73.4	68.2
Not owned	31.9	26.5	31.8

Chi^2 value 0.832; P : N.S.

Values are percents of each group

Table 129

NUMBER OF ROOMS ACCORDING TO THE NUTRITIONAL GROUPS

Number of rooms	Well nourished Group A	Malnourished Group B	Total
One	29.8	29.2	29.9
Two	43.4	44.6	43.5
Three	17.9	18.4	18.0
Four	4.9	4.6	4.9
Five and more	3.7	3.0	3.7

Chi^2 value 3.622; P : N.S.

Values are percents of each group

Table 130

COOKING FACILITIES OF THE TWO NUTRITIONAL GROUPS

Type of cooking facility	Well nourished Group A	Malnourished Group B	Total
Wood fire	1.2	1.5	1.3
Kerosene	67.7	66.1	67.7
Butane gas	30.9	32.3	31.0

Chi^2 value 0.091; P : N.S.

Values are percents of each group

Table 131

SOURCE OF WATER ACCORDING TO THE NUTRITIONAL GROUPS

Source of water	Well nourished Group A	Malnourished Group B	Total
Municipal water in the house	76.8	72.8	79.1
Tap water in the village	0.9	3.3	1.0
Spring in the village	2.9	5.0	3.0
Collection wells	16.3	18.6	16.4

Chi^2 value 5.103; P : N.S.

Values are percents of each group

5. Household amenities: The availability of five main household amenities (bathroom, butane gas, refrigerator, electricity and toilet) are shown in Table 132. Of these, the availability and type of toilet showed the only significant relation to the state of nutrition ($P < 0.01$) Table 133.

Discussion of Household Amenities: House ownership in this rural area was shown to have no relation to the nutritional status of the children. This is understandable when we know that those who are not owners of their houses are either living on the farms where they work, free of charge, or they pay a small amount of money which is expected not to affect the basic economic needs of these families.

Water supplies and resources in Jordan are very scanty. In some dry years drinking water can be in very short supply. Municipal supplies provide water to about 75 per cent of the people in this community and it is supposed to be the safest source. The remaining people are drinking relatively unsafe water. Contamination of the other three sources of water could occur in different ways. There is not much control or chlorination of the public springs in the village; contamination might directly follow after the drawing of water. Transport and storage are the main two steps where most of the contamination occurs. The difficulty encountered in carrying the water from the main source in the village to the house which might be on a nearby hill or on a farm will make the water a valuable item, used only for drinking purposes and not for cleaning and washing; this might result in deterioration of the general health.

Table 132

HOUSEHOLD AMENITIES ACCORDING TO THE DEGREES OF NUTRITION

Availability	Bathroom		Butane Gas		Refrigerator		Electricity		Toilet	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Available	22.1	18.4	31.8	33.8	9.2	6.1	44.3	48.4	90.4	81.5
Not available	77.8	81.5	68.1	66.1	90.7	93.8	55.6	51.5	9.5	18.4
Chi^2 value	0.505		0.121		0.733		0.428		5.877	
P	N.S.		N.S.		N.S.		N.S.		<0.01	

Values are percents

Group A = the well nourished, and Group B the malnourished children

N.S. = not significant

Table 133

TYPE OF TOILET ACCORDING TO THE NUTRITIONAL GROUP

Type of toilet	Well nourished Group A	Malnourished Group B	Total
Cement	21.5	9.4	15.5
Soil ditch	78.4	90.5	84.5

Chi^2 value 4.556; $P < 0.01$

Values are percents of each group

Collection wells used to be thought of as a safe source of drinking water for children and adults, especially by the action of the precipitation process. During the last years and as a result of overcrowding in these villages, many people have their septic tanks near the collection wells. The septic tanks seeped and caused contamination and spread of many enteric infections.

Recently, while this section was under preparation, I read a report of an epidemic of poisoning in Salt town as a result of contamination between the sewage septic tanks and the corroded water pipes which were leaking. In this epidemic, there were more than 2,500 cases of poisoning which were caused by an unidentified virus; there were about 50 cases with signs and symptoms of encephilitis.

It was clear from the data on the availability of some household amenities that a toilet made of cement was the only item which had a significant relation to nutrition. Those who had soil ditch (about 20 per cent) were not very much different from those who had no toilets at all (about 10 per cent); both were more common among the malnourished children.

Because electricity is always a municipal or governmental project, it did not have meaningful significance in relation to health in this district.

e. ACCESS TO HEALTH SERVICES

I ACCESS TO HEALTH SERVICES IN THE AREA

The activities of the health services in this rural area could be best illustrated by examining the health services available to both the children and to the pregnant women in the antenatal, natal and post-natal periods.

The visits paid by the midwife or nurse to the pregnant women reflect the extent of the medical services and its spread to the most vulnerable section of the people in this community. The visits of the mothers when pregnant to MCH centres reflect the level of health education those mothers had; also, the time (trimester) of visits to these health centres might be another indicator of the degree of health education: the earlier the visit the better the level of health education.

The place of birth (hospital versus house) might be used as a crude indicator of the level of health education for the families as well as an indicator of the level of the spread of health services available to the people.

Hospital delivery in this community does not reflect the level of economic status, it simply indicates that the pregnancy or delivery was complicated and that the pregnant women were referred to the hospital to be under the care of a specialist.

Table 134 and Table 135 show that only a small number of nurses or midwives visited the pregnant women during the course of pregnancy. There was no difference between the women in Group A and Group B. Also, only a small number of pregnant

Table 134

VISITS PAID BY THE NURSE OR MIDWIFE TO THE PREGNANT WOMEN
DURING THE COURSE OF PREGNANCY
IN THE TWO NUTRITIONAL GROUPS

Nurse or midwife's visits to pregnants	Well nourished Group A	Malnourished Group B	Total
Visited	8.8	10.7	8.8
Did not visit	91.2	89.2	91.2

Chi^2 value 0.307; P : N.S.

Values are percents of each group

Table 135

VISITS PAID BY THE PREGNANT WOMEN TO THE MCH CENTRES
DURING THE COURSE OF PREGNANCY
IN THE TWO NUTRITIONAL GROUPS

Pregnant mothers' visits	Well nourished Group A	Malnourished Group B	Total
Visited MCH	14.9	14.0	15.0
Did not visit	85.0	85.9	85.0

Chi^2 value 0.043; P : N.S.

Values are percents of each group

women visited the existing MCH centres. Most of those pregnant women who visited the MCH centres did so in the second trimester (Table 136).

Table 137 shows that most of the deliveries were performed in the home. Only 17 per cent were hospital deliveries but there were more hospital deliveries among the malnourished group, which might indicate that they had complicated pregnancies or deliveries.

Table 138 shows that only 14 per cent of the children visited the MCH centres and 4 per cent were hospitalized; there were not significant differences between the two nutritional groups.

However, 52 per cent of the well nourished group and 38 per cent of the malnourished children visited the doctors' out-patient clinics (OPD). These differences were significant statistically at the 1 per cent level, but there was no significant difference in the number of visits paid by these children to the MCH centres (Table 139) during the previous six months.

The visits paid to a private or governmental clinic might indicate that either the economic level or these families is better, so that they can afford it or that their level of health education is higher, so that the moment the parents feel that their child is sick they send him to a doctor. The economic influence could be well illustrated by the fact that the season of harvesting and the end of the month (the time people receive their salaries) are the busiest days for the practitioners in this community as well as for the whole country.

Table 136

TIME WHEN PREGNANT WOMEN VISITED MCH CENTRES IN THE TWO NUTRITIONAL GROUPS

Time (trimester)	Well nourished Group A	Malnourished Group B	Total
First trimester	23.6	25.0	23.6
Second trimester	66.8	50.0	66.6
Third trimester	9.5	25.0	9.8

Chi^2 value 2.271; P : N.S.

Values are percents of each group

Table 137

PLACE OF BIRTH OF THE CHILDREN ACCORDING TO THE DEGREE OF NUTRITION

Place of birth	Well nourished Group A	Malnourished Group B	Total
Home	82.3	75.3	82.2
Hospital	17.6	24.6	17.8

Chi^2 value 2.100; P : N.S.

Values are percents of each group

Table 138

CHILDREN'S HOSPITALIZATION, VISITS TO MCH CENTRES AND VISITS TO DOCTORS' OUT-PATIENT CLINICS ACCORDING TO THEIR DEGREE OF NUTRITION

Attendance at health centre or clinic	Well nourished Group A	Malnourished Group B	Total	P (Chi^2)
MCH visits	14.3	10.7	14.3	N.S.
OPD visits	52.2	38.4	52.0	<0.01
Hospitalization	4.0	1.5	4.0	N.S.

MCH = Maternity and Child Health Centre; OPD = visits to Doctors' out-patient department

Values are percents of each group

Table 139

NUMBER OF VISITS PAID BY THE CHILDREN TO THE DOCTOR'S CLINIC ACCORDING THE THE NUTRITIONAL DEGREE

Number of visits	Well nourished Group A	Malnourished Group B	Total
1	24.8	28.0	24.9
2	29.6	24.0	29.6
3	13.9	16.0	14.0
4	10.4	12.0	10.5
5	6.6	8.0	6.7
6+	14.4	12.0	14.3

Chi^2 value 5.381; P : N.S.

Values are percents of each group

Many of the mothers who never attended the MCH centres felt that it was unnecessary to do so as long as their children were never seriously ill. Thus mothers tended to consider the MCH centres as primarily a treatment centre and were not aware of the other services (like vaccination) that they provided. Perhaps this is not suprising as the approach of Western health care systems has been to invest curative systems with more finance and prestige.

If full advantage is to be taken of the comprehensive services offered by the MCH clinics, then health education programmes in each of these villages should stress the preventative aspects of the clinic services.

It is also advisable to have the antenatal clinics integrated with child health clinics. This would provide a good contact point for disseminating information to the mothers on the benefits of regular attendances at MCH clinics once the baby is born. It would enable a pregnant mother to bring with her at each antenatal clinic visit, her other pre-school age children for routine preventative measures or, where necessary, for treatment.

II OBSTETRICAL DATA

The obstetrical data related to the mothers of the children in this study deal with the following aspects:

1. The age of the mother when married is shown in Table 140 In both groups the commonest age of marriage was 20-25 years, but the mothers of malnourished children tended to marry younger.

2. The number of pregnancies the mothers in the two nutritional groups had is shown in Table 141 Mothers in Group A tended to have less than five pregnancies, while most of those in Group B tended to have more than five pregnancies. The mean number of pregnancies in the two groups is almost the same, in the well nourished group 6.2 and in the malnourished group, 6.5 pregnancies per woman.

It is important to point out here that the high number of pregnancies does not imply that the number of living children is proportionately high, because mortality among those children may also be high.

3. Intervals between pregnancies. Table 142 shows that the mean value of the interval between pregnancies (birth interval) for the well nourished group was 1.7 years and for the malnourished group was 1.6 years. This difference was not significant at the 5 per cent level.

4. The person who did the delivery, according to the two nutritional groups is shown in Table 143. There is a tendency for the mothers of the malnourished children to be delivered either by a doctor or by the mother herself; this shows the two extremes

Table 140

AGE OF THE MOTHER WHEN MARRIED ACCORDING TO THE TWO NUTRITIONAL GROUPS

Age (years)	Well nourished Group A	Malnourished Group B	Total
Less than 15	8.0	12.6	8.1
15 - 20	28.0	38.0	28.2
20 - 25	55.3	46.0	55.2
25 - 30	7.3	3.1	7.3
30 and more	1.1	0.02	1.2

Chi^2 value 7.077; P : N.S.

Values are percents of each group

Table 141

NUMBER OF PREGNANCIES IN THE TWO NUTRITIONAL GROUPS

Number of pregnancies	Well nourished Group A	Malnourished Group B	Total
1	3.4	1.5	3.4
2	7.8	9.3	7.8
3	10.3	9.3	10.4
4	11.9	10.9	11.9
5	11.9	9.3	11.9
6	11.5	10.9	11.5
7	9.3	12.5	8.8
8	7.2	10.9	9.3
9	7.5	10.9	7.3
10	3.7	4.6	7.6
11+	15.0	9.4	10.1
Mean number of pregnancies	6.2	6.5	

Chi^2 values 15.279; P:N.S.

Values are percents of each group

Table 142

INTERVALS IN YEARS BETWEEN PREGNANCIES

Interval (year)	Well nourished Group A	Malnourished Group B	Total
1	36.7	42.1	36.8
2	59.4	54.6	59.4
3	3.1	3.1	3.2
4+	0.8	0.2	0.6
Mean in years	1.7	1.6	

Chi^2 value 1.155; P : N.S.

Values are percents of each group

Table 143

PERSON WHO DID THE DELIVERY ACCORDING TO THE NUTRITIONAL DEGREE

Person who did the delivery	Well nourished Group A	Malnourished Group B	Total
Mother alone	15.60	22.2	15.8
Trained woman	49.60	38.10	49.4
Registered midwife or nurse	27.90	30.10	27.9
Doctor	6.80	9.5	6.9

Chi^2 value 4.111; P : N.S.

Values are percents of each group

of health care in this group. Deliveries done by the doctor are those which had been performed in the hospital by a doctor most probably because they were complicated pregnancies or complicated deliveries; however, most of the mothers in the well nourished group were delivered either by a trained woman in the village or by a registered midwife.

The hazardous effect of having the mother take care of her delivery procedure herself is known among the villagers in this community; while the mother is mainly concerned with the procedure of delivery as a whole, and while she is in pain and distress little attention is being paid to the neonate who might need simple life saving recussitation measures by her.

The higher prevalence of deliveries performed by a doctor does not necessarily reflect a better health standard or a higher economic level, unless they were difficult or complicated they would not have been done by the doctor himself.

However, deliveries performed by a registered nurse or midwife might indicate the level of spread of this relatively efficient medical care in the community; and also to some extent the economic standard of these families.

The same data indicates that about one half of the deliveries in Group A and more than one third of the deliveries in Group B were performed by a trained woman in the village.

5. The number of abortions and stillbirths according to the nutritional groups are

Table 144

NUMBER OF ABORTIONS AND STILLBIRTHS IN THE TWO NUTRITIONAL GROUPS

Number of abortions and stillbirths	Well nourished Group A	Malnourished Group B	Total
1	50.9	25.0	50.4
2	24.6	41.7	24.9
3	13.2	17.7	13.3
4	5.6	4.2	5.6
5	2.0	0	1.9
6	1.4	8.3	1.5
7 and more	2.2	4.2	2.4
Mean	1.99	2.54	

Chi^2 value 15.826; $P < 0.01$

Values are percents of each group

shown in Table 144. The malnourished group had more abortions and stillbirths. The difference was significant at the 1 per cent level when the number of abortions and stillbirths was only one, there were more abortions and stillbirths among the well nourished group. The mean number of abortions and stillbirths for the well nourished group was 1.99 per woman and 2.54 for the malnourished group. The significance of this point will be discussed later.

6. The number of siblings born alive in the two nutritional groups is shown in Table 145 the difference was not significant at the 5 per cent level.

Table 145

NUMBER OF SIBLINGS BORN ALIVE IN THE TWO NUTRITIONAL GROUPS

Number of liveborn siblings	Well nourished Group A	Malnourished Group B	Total
1	4.8	4.7	4.8
2	9.1	9.4	9.1
3	12.9	11.0	12.9
4	13.0	15.6	13.1
5	12.8	7.8	12.7
6	13.0	12.5	13.0
7	9.5	14.0	9.6
8	8.1	6.2	8.1
9	6.3	9.4	6.3
10	5.4	7.8	5.5
11 and more	4.8	1.6	4.9
Mean	5.5	5.6	

Chi^2 value 6.849; P : N.S.

Values are percents of each group

Discussion of the Obstetrical Data: The early marriage of women and especially the mothers in the malnourished group might reflect some economic as well as social causes. On the one hand most of the girls are not working, they are not wage earners and so they are a heavy burden on the economy of the family; on the other hand the early marriage of such girls is an opportunity for the father to take her dowry and use it for other needs of his family.

The social aspects of early marriage could be summarised by the fact that girls in this community, because of traditional social and religious factors are not allowed to establish any relation with the other sex except by the legal religious marriage. For many of the girls and their families this may be an end to their troubles.

The large number of deliveries performed by trained women in this community reflects the high social and economic acceptance of this type of maternal service. The fact that about half the total deliveries were performed by these trained women leads the discussion into a different aspect:

a) As long as the number of registered nurses and midwives in this community is not enough to meet one quarter of the need, and as long as the acceptance by the people of these well trained nurses and midwives is still poor, then one would say that even with proper health planning and proper health education, it will take the country quite a few more years to have half the required number of nurses and midwives. Probably it will take those people many more years before they will change their attitude and beliefs about the trained women in the villages.

b) One may ask what is the solution to this problem? The most efficient and economical approach will be two sided; first, to raise the educational and professional standard of these trained women, secondly, continuous recruitmens of sufficient numbers of registered nurses and midwives not only for work in hospitals but also for field work. The training of the village women could be organised and financed by the Ministry of Health. With proper incentives, financially and professionally, there is great hope that through refresher courses in the Government maternity hospitals these trained women will eventually be changed, if not into better midwives at least into less harmful ones.

Finally, on this topic, the repeated abortions and stillbirths would eventually decrease the birth interval which will ultimately cause maternal depletion and probably small for dates babies.

The following flow chart in figure 41 summarizes the main obstetrical data in this section as well as some other related data. The chart in figure 42 provides some indications of possible solutions.

Figure 41

Obstetrical Flow Chart (The Problems)

Early marriage, poor knowledge of child care and feeding method
(50 per cent of all marriages <20 years).

↓

Poor prenatal care

↓

High number of pregnant women in the community
(40 per cent do not like being pregnant, 68 per cent of them use no contraceptives)

↓

Only 14 per cent of pregnant women visited MCH centres
Only 8 per cent of pregnant women were visited by a midwife (home visit)

↓

Low number of deliveries by registered midwives (26 per cent)

↓

High number of deliveries by untrained women (61 per cent)

↓

Short intervals between pregnancies (1.6 years)

↓

High stillbirths and abortions (115/1000)

↓

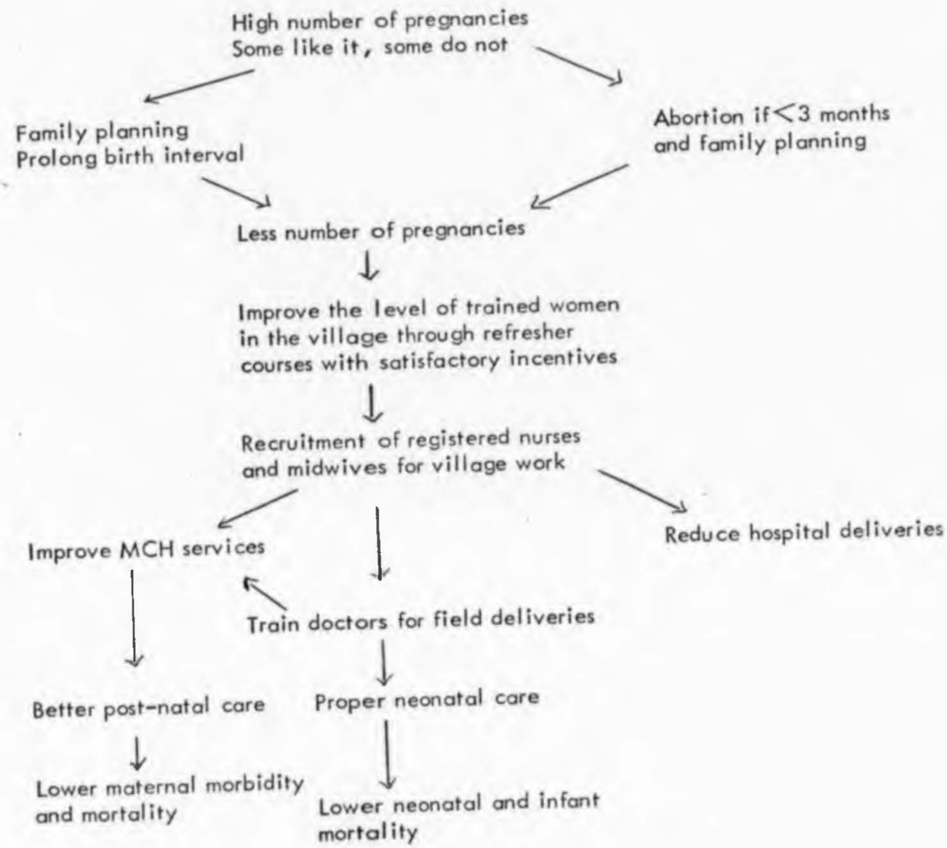
High neonatal mortality (26/1000)

↓

High incidence of birth injuries.
(Look at the list of children excluded from the study)

Figure 42

Obstetrical Flow Chart (The Solution)



iii. USE OF CONTRACEPTIVES

In the general section on childrens' families and their environment, emphasis was mainly on the attitudes of mothers towards having more children. In this section the main emphasis is on the use and type of contraceptives.

Table 146 shows that about one third of the women in this study are using one form or another of contraceptives, and Table 147 shows that of the contraceptive methods used, the pill had the highest frequency. Other local methods were employed by about 16 per cent of those who used contraceptives. In the following sections this point is discussed in more detail.

To our knowledge, the use and types of contraceptives in this community have never been studied before. The other means used locally deserve further investigation to find out their advantages as well as their disadvantages.

Table 146

THE USE OF CONTRACEPTIVE MEANS AMONG THE WOMEN IN THIS STUDY

Use of contraceptives	Well nourished Group A	Malnourished Group B	Total
Users	32.5	35.4	32.6
Non users	67.4	64.5	67.4

Chi^2 value 0.893; P : N.S.

Values are percents

Table 147

TYPES OF CONTRACEPTIVE MEANS USED
BY WOMEN IN THIS STUDY

Type of contraceptive used	Well nourished Group A	Malnourished Group B	Total
Pills	79.2	70	79.1
Intrauterine device (IUD)	0.4	10	4.4
Others	16.4	20	16.4

Chi^2 value 0.893; P : N.S.

Values are percents

iv VACCINATION

Widespread use of effective vaccines has become probably the most important contemporary practice in preventive medicine. The recent increase in activity in vaccine research and development has greatly enhanced immunization programmes (Dull, 1971).

Most of the vaccines now in routine use have become available only since the early to mid-twentieth century. Within the last decade alone, four effective live attenuated virus vaccines against poliomyelitis, measles, mumps and rubella have been put into use.

It was almost a century ago that Louis Pasteur demonstrated a vaccine for post exposure treatment ofrabies, a concept still employed today, and more than 175 years ago that Edward Jenner undertook his work on smallpox prophylaxis that led to the worldwide eradication of smallpox.

It is a very practical aim to vaccinate the maximum number of people against the maximum number of diseases at one visit. The combination of vaccines permits the administration in a single injection of several vaccines to one person.

The percentages of children who were vaccinated against the following diseases are shown in Table 148 ; triple, poliomyelitis, smallpox, measles and BCG. Vaccination against smallpox had the highest frequency (45.4 per cent) and against measles the lowest (4.9 per cent).

Only about one third of all the children were vaccinated with triple, polio and BCG.

The only vaccine which showed a significant difference between the well nourished and malnourished group was measles; there were more children vaccinated against measles in the well nourished group ($P < 0.05$).

Discussion of Vaccination: The efficacy and harmlessness of the triple vaccine combination (diphtheria, tetanus and pertussis) is well documented and has been confirmed many times (Chen et al. 1956 and Barr et al. 1955). The value of a single dose of tetanus toxoid in pregnant women has been stressed by Stanfield (1973).

Table 148 shows that almost one third of the children were vaccinated with both triple and polio vaccines. This is simple because in any governmental or private vaccination centre, the two vaccines are almost always available together and those who come for vaccination are ready to accept any number of vaccinations in the same visit, a finding which confirms the idea that the maximum number of vaccines should be given on one occasion if possible.

It was also noted that there was no sharp fall off in the number of vaccinated babies who came for second and third doses, which might suggest that those who accept the vaccination procedure are fully convinced of its value. This high attendance for the following doses is important because initial immunization against polio is only fully effective if two or three doses of the vaccine are given. One of the major

Table 148

PERCENTAGES OF CHILDREN VACCINATED WITH FIVE DIFFERENT VACCINES IN THE TWO NUTRITIONAL GROUPS

	Triple			Poliomyelitis			Smallpox			Measles			BCG		
	Group A	Group B	Total	Group A	Group B	Total	Group A	Group B	Total	Group A	Group B	Total	Group A	Group B	Total
Vaccinated	30.3	36.9	30.4	31.7	39.0	31.9	45.3	48.4	45.4	4.9	0.6	4.9	33.2	39.0	33.4
Not vaccinated	69.6	63.0	69.6	68.2	60.9	68.1	54.6	51.5	54.6	95.0	99.3	95.1	66.7	60.9	66.6
Chi^2 value		1.309			1.546			0.242			3.274			0.946	
Degrees of freedom		1			1			1			1			1	
P		N.S.			N.S.			N.S.			<0.05			N.S.	

Values are percents of each vaccine

N.S. : not significant at 5% level

problems encountered in this type of phased immunization programme (as in DPT) is the rapid decrease in attendance at successive vaccination sessions. For operational reasons this type of prophylaxis is still beyond the scope of mass immunization programmes, and is therefore confined to protection of individuals without immediate epidemiological impact.

Very low sera conversion with polio vaccine has been one of the problems of polio vaccination programmes. Various explanations are offered for this. Interferences between entero-viruses and vaccine strains has been incriminated by many authors. Antibodies present in human breast milk are said to be capable of neutralizing polio viruses (Sabin, 1950); however, Adcock and Green (1971) have shown that an interval of two to three hours between breast feeding and vaccination was sufficient to overcome inhibition of the response.

Malnutrition and protein deficiency and improper storage of live vaccine have also been incriminated as responsible for the lowered response. Another factor may be the use of improper vaccine schedules (Sabin et al. 1960). The same authors emphasised that for optimum results the vaccine should be applied in mass campaigns where a very high proportion of susceptible children are fed simultaneously, thus providing an opportunity to replace the entero viruses with the vaccine strain, partly by direct feeding and partly by widescale spreading of the vaccine strains to contacts.

Robins (1971) emphasized the fact that epidemics of poliomyelitis are beginning to appear in parts of the world where it was formerly endemic. If trends continue, paralytic cases with the accompanying permanent disability will increase.

Smallpox vaccine had the highest prevalence among the five types of vaccine in this community; it was actually the first vaccine to be used in the country, obligatory by law and obligatory for travelling. The people's concept of smallpox as a killing and rapidly spreading disease permits the high frequency of vaccination of children.

The protection provided by BCG in this community can best be assessed by a longitudinal survey such as the Medical Research Council's BCG trial carried out in 1956 where protection was estimated as 80 per cent (Springett, 1965). Over the last ten years it has become apparent in many countries that the use of a preliminary test with tuberculin is unnecessary and that BCG given to tuberculin positive children is harmless (Morley, 1973).

When reviewing the Annual Report of the Department of Chest Diseases in Jordan (1974) one finds that the general BCG campaign in Jordan has covered 70 per cent of those who required the vaccine. By comparing this figure with the number of pre-school children in this community, who were given the BCG vaccine, we find that only half the number reported by the Department were in fact vaccinated. This might indicate that the campaign is covering mainly the adult population and school children to whom there is easy access, unlike the children of pre-school age in a rural community. New cases of tuberculosis for the year (1974) were mainly in adults none in a child which might indicate severe under-reporting of childhood tuberculosis.

Because measles in Jordan carries a special significance from the point of view of mortality and morbidity, it is justifiable to devote some space to the discussion of this topic.

Attenuated measles vaccine is among the most reliable and effective of all known live vaccines. Agboton and Rey (1971) suggested that protection produced by measles vaccine could be as high as 95 per cent in experimental studies, but that in mass campaigns sero-conversion of 85 per cent could be expected. Live vaccine is said to be ineffective in children under the age of six months because of the presence of circulating maternal antibodies, and only moderately effective between the ages of six to nine months. Krugman and Giles (1970) reported 80 per cent of sero-conversion in children between the ages of nine and 12 months and 97 per cent of sero-conversion in children over the age of 12 months. However, because measles in Jordan is reported at a relatively young age it would be advisable to give the vaccine at the age of nine to 12 months, and risk a lower rate of sero-conversion, rather than to withhold vaccination until a later age, in order to ensure a higher rate of sero-conversion, but risk the child developing a disease which might be fatal.

Another problem encountered with the measles vaccine is its instability. In spite of freeze drying, measles vaccine is very sensitive to heat and light. It is stable at 4° C for up to a year, but at 45° C the vaccine is inactivated in two to three days. This may at times account for the relative failure of the vaccination campaigns against measles to induce protection. This is another important factor when carrying on such campaigns in our clinics, where cooling facilities are not available

The medical and para-medical attitude in Jordan towards measles vaccination may be another drawback. Doctors and nurses believe that measles must hit every child, and so there is not much benefit from using the vaccine; on the other hand, many people believe that the rash in measles should 'come out' otherwise measles could be fatal, and if not they seek medical advice asking for an injection which would let the rash 'come out'. It is becoming the routine for many doctors to give any injection to satisfy the anxious parents. The background of this story probably is the fact that doctors used to give injections to children suffering from very high pyrexia (the prodromal stage of measles) and it happened that on the same day when they were given the injection, the rash appears, an event which increased the parents' trust and belief in these injections.

No vaccination campaign should start unless provision is made for an active continuing programme. The cost of the programme must be assessed before any immunization is started and such costs must take into account an annual programme of immunization, in order to keep the disease from spreading rapidly in epidemic form throughout the community (Perkins, 1975).

In the United Kingdom and United States it has been shown that maternal antibodies markedly affect the success of immunizing children and in both countries immunization is delayed until after the first birthday (Perkins, 1975).

Although great emphasis is placed upon the cost of the measles vaccine, which is certainly the most expensive of those used to eradicate childhood diseases, the cost of the vaccine is a small fraction of the total cost of an immunization programme set up to eliminate all infectious childhood diseases (Perkins, 1975).

Because the cost of measles vaccine is high, Hendrisekse (1975) suggests that the only sensible policy at the present time would be to offer measles vaccination to specific high risk groups and in certain exceptional circumstances, such as the control of outbreaks in refugee camps or following natural disasters. Measles vaccination may also be possible in limited areas where good medical facilities have been established and local resources are sufficient to support the programme without curtailing activities in basic health services.

Griffith (1975) suggested the following points as basic needs for an effective vaccination programme against measles:

1. Storage and distribution: facilities for material which must be maintained at about 4° C until immediately before use.
2. Suitable containers and transport for distribution of vaccine to the periphery.
3. Adequately trained staff for:
   a. preparatory arrangements for vaccination sessions
   b. administration of vaccine to all healthy susceptible infants attending vaccination sessions

c. maintenance of adequate records of vaccination

d. maintenance of an advisory service during the immediate post vaccination period

4. Adequate supplies of measles vaccine and injectors.

Integration of a measles programme with other childhood vaccine programmes could allow wider benefits to be derived with little increase in cost.

Morley (1975) has stressed the fact that almost all children unprotected by the vaccine get measles; epidemics in Glasgow in the first decade of this century showed a case fatality rate of 5 per cent. In the 19th century measles had a prominent place as a major cause of death (Morley 1975).

The clinical impression in measles is that the severity of the disease depends on the child's nutritional state. It is certainly more severe where protein energy malnutrition is common (Morley, 1964). It has been shown that measles in breastfed children is a milder disease than in those who are weaned; although the efficiency of immunological mechanisms as well as the general nutritional state may be implicated. Hendrickse et al. and Lowenstein (1963) have also drawn attention to the high mortality rate from measles when it is associated with malnutrition, and the vicious circle set up by such an infection in an undernourished child. The case fatality rate in a village in South Jordan where malnutrition was common was about 50 per cent (Pharaon, Hijazi, 1966, Report to the Minister of Health).

Hartfield and Morley (1963) reported that measles vaccinated children have been shown to gain more weight in the subsequent months than unprotected controls.

Sutherland et al. (1971) calculated that in the United Kingdom vaccination of about 10 per cent of the child population has reduced the attack rate by two thirds. Nevertheless, there were local outbreaks in some areas that has used vaccine, although the cases were not occurring in those who had been vaccinated. Griffith (1973) has suggested that a low incidence of vaccination (50 per cent) would merely postpone a major epidemic. The epidemic cycle would shift from a two year to a three year period and this would do nothing more than increase the age incidence of the disease by a factor of 2.

The Age at Vaccination: In establishing the optimum age for immunization the following points shoud be considered:

1. At what age would an unvaccinated child be most susceptible to the disease.
2. At what age would the effects of the disease be most severe.
3. Up to what age would maternal antibodies in breast milk interfere with antibody formation in the child.
4. At what age would a child be most likely to come in contact with the medical services in order to be able to receive vaccination.

Vaccination and Education: It is suggested that greater emphasis during health education lessons should be placed on the purpose of vaccination, and the importance of completing immunization schedules. It was also revealed during the field survey that many ~~others~~ mothers did not know anything about the vaccinations needed for their children.

There is a need for the medical and para-medical personnel to be convinced of the real value of the different vaccines and especially measles vaccine, before starting any mass vaccination programme.

f. EDUCATION

The educational level of parents was judged by the following:

1. The degree of literacy of the parents: Table 149 shows that most of the mothers and about 30 per cent of the fathers were illiterate. There were relatively more literatues among the parents of the well nourished group but not to a statistically significant level.

The degree of literacy among parents in this study does not necessarily reflect the present status of education in Jordan. The present educational level represents the parents when they were at school age 10-15 years ago; since then there have been big changes in the level of education due to the rapid expansion of schooling in almost all parts of the country.

2. Mothers impression of child's health: this question was asked especially to evaluate the educational level and the concepts of mothers about their children's health. There are more mothers in the malnourished group who believe that their children are fat which might indicate wrong concepts of the mothers in the meaning of fatness in relation to health (Table 150). About 24 per cent of the mothers of well nourished children believe that their children are skinny and thin. This also reflects the other extreme, the anxiety of the mothers about the health of their children, even those which we call in this study the well nourished group. Moreover, we see from the table that the mothers' impression of fatness and thinness very often does not agree with the objective assessment of the child.

This will lead us to raise the question of the mothers' concepts and beliefs about their children's health level before starting any health and nutrition rehabilitation programme.

Table 149

PARENTS' LITERACY IN THE TWO NUTRITIONAL GROUPS

	Group A		Group B		Total	
Literacy	Mother	Father	Mother	Father	Mother	Father
Illiterate	68.4	31.9	73.8	41.5	68.6	32.1
Literate	31.5	68.0	26.1	58.4	31.4	67.9

Chi^2 value for mothers: 0.853, P : Not significant

Chi^2 value for fathers: 2.697, P : Not significant

Values are percents of each group

Table 150

MOTHERS' IMPRESSION OF THEIR CHILDREN'S HEALTH IN THE TWO NUTRITIONAL GROUPS

Mothers' Impression	Well nourished Group A	Malnourished Group B	Total
Fat	7.5	9.2	7.6
Normal	67.6	64.6	67.6
Thin	23.9	24.6	24.0
Don't know	0.8	1.5	0.9

Chi^2 value 0.674 P : N.S.

Values are percents in each group

2. ECONOMIC DEVELOPMENT, CHANGING FEEDING PRACTICES AND THE THREAT OF EARLY OBESITY

Examination of the data on skinfold thickness in this community reveals that the partially breastfed children had significantly higher values of combined triceps and subscapular skinfold thickness than those who were only breastfed; the same was true for weights and heights.

If, as a crude index, we define obesity in infancy and early childhood as a combined (triceps + subscapular) measurement of over 20 mm, then when we apply this criterion to our children we find that about 2 per cent of the males and 2.8 per cent of the females in the first six months of life were obese.

However, if we examine the figures on feeding and weaning we find that about 6 per cent of all the children had never been breastfed; the introduction of solid foods and cow's milk started as early as two months in some other cases. Comparing the rapidly changing community of today with what it was just a few years ago (ICNND, 1964) when almost all children were breastfed during the first three months of life, one should always remember the potential risks of obesity; the main concern of the medical profession nowadays in the industrialized countries.

Many factors contribute to the development of obesity in children, and although there are many gaps in the present state of knowledge, the aetiology must be considered multi-factorial (Lloyd, 1969); the important factors are genetic, endocrine and dietary.

Note pagination changes

It is beyond the scope of this study to discuss the importance of all these factors in more detail. However, because dietary factors form a potential hazard to our children, especially in the light of the facts mentioned above, it is appropriate to discuss them in more detail.

Feeding in the early post-natal period is important, Widdowson (1960) showed that rats given a large amount of milk during the first three weeks after birth grew more rapidly than their litter-mates who received less milk. This weight difference was maintained even after weaning. In the rat early nutritional experience has been shown to have a permanent effect on the number of adipose cells (Knittle and Hirsch, 1968). An increase in size and number of adipose cells in obesity has been demonstrated (Hirsch, Knittle and Salan, 1966). Also children who were obese at one year were found to have increased adipose cell size and number in later life (Brock, Lloyd and Wolff, 1972).

About 80 per cent of overweight children have been shown to remain obese in adult life (Lloyd, Wolff and Whelon, 1961, and Abraham and Nordsieck, 1960) and about 30 per cent of obese adults have been obese since childhood (Mullins, 1958). Another study (Asher, 1966) showed that infants who were over the 97th percentile for weight in the second six months of life were significantly heavier than the controls at five years. In a later study, where weight for height was used as a crude index of obesity (Miller et al. 1972) showed a highly significant correlation in females between the weight gain in the first three years of life and the weight for height ratio at the age of 22 years.

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The second reason for such a combined programme is the incentive that food and nutrition services provide for the utilization of health facilities, thereby bringing more people into contact with family planning information and services and by doing so, increasing the number of those who accept family planning. The advantages of combining nutrition and family planning programmes are beginning to be recognised (Anderson, 1975).

When examining the number of mothers who would like to have more children and those who would not, against both the age distribution of these mothers and the present number of children they have, we find that those women who do not wish to have more children are the young ones (25-30 years old) who already have several children (more than 3-4 children). In this young age group, social, economic and educational factors play an important role.

The harmful effect of short birth intervals (birth interval in this study was about 19 months) is well known (Morley, 1973); also, it has been noticed that in this community malnutrition is becoming a disease of the younger infant especially when we look at hospital admissions (Hijazi, 1974) where the mean age was about 7 months. In communities with a longer birth interval, malnutrition is more common in an older age group (18 months to three years)

The 'catch up' phenomenon is believed to be less in evidence after severe malnutrition in infancy and early childhood, and such children are expected to grow up stunted in their physical growth (Thomson, 1970 and Cravioto, 1970). In the areas with a short birth interval there are many adults who have grown up in rural areas where malnutrition is common who are shorter than those who have grown up in the better environment of the city. In these countries, short and stunted adults are more common in the rural societies than in those countries with long birth intervals.

This emphasizes the need to concentrate on birth interval as a priority in a family planning programme rather than on the size of the family. The mother who has used family planning methods to separate the birth of her children is unlikely to have an over-large family. Morley (1973) states that medical workers when caring for a mother and her young child, will come to realize that delaying the next conception and extending the birth interval are quite as important a part of health care as seeing that the latest child is adequately immunized. Those caring for children are in an ideal position to advise on 'birth spacing'. It is in these centres and clinics where the best contact between the health workers and the mother occurs; or as Morley put it, "most important of all, the mother is coming for help for her child and family planning is an answer to a felt need".

Experience in other parts of the world (Morley, 1973) has shown that once mothers realize that their children are likely to survive, their desire for having more children diminishes. This attitude was not examined in this study, although we had the impression that women who had lost children tended to want more, and young mothers with more than 3-4 surviving children did not want more children. Similarly, in Nigeria (Cunningham, 1972, quoted by C.E. Taylor, 1975) women from a village where five years of excellent child care had caused a dramatic improvement in child mortality and morbidity tended to want far fewer children than those from a central village.

The cost of the pill is another important feature of contraception. The cost of a one month supply in Jordan is in the range of 0.30-0.50 J.D. (about 1.5 per cent of the monthly income of a lower middle class man in Jordan). The intra-uterine dev ce was not widely used by the women in this study. Many had wrong concepts about its use and possible harmfulness.

The high percentage of women using (other) contraceptive means (27.8 per cent) might indicate two possibilities: firstly, they have no access either to pills or to IUD's because they have never been informed about them. (In Jordan there are no official governmental or private family planning programmes) or, secondly, because they cannot buy pills regularly.

There is another added difficulty as regards the use of IUD's, that is that it has to be introduced either by a doctor or by a trained nurse or midwife. These people are not always available, and even if they were, the device has to be bought which is costly for many low income people.

We were surprised to find the large scale of locally used contraceptives, and because they might have some harmful effects, it is worth listing the most common forms used:

1. The use of a piece of cotton or cloth soaked with olive oil or cream and inserted into the vagina before intercourse.

2. Prolonged breast feeding.

3. Use of protective device by the man.

4. Use of a vinegar wash before intercourse.

In Jordan, as in many other parts of the world, there has been a traditional belief, especially in this rural community that breast feeding has a contraceptive effect, and delays the onset of the next pregnancy.

In recent years, scientific evidence has accumulated from studies in Europe and from metabolic and field investigations in many parts of the world, which supports this folk experience and indicates that lactation does indeed have a contraceptive effect, presumably because the prolactin and other hormones of the lactogenic complex secreted by the anterior pituitary as a response to sucking the breast, inhibited ovulation. Ovulation and menstruation are delayed for at least ten weeks and even up to 26 months, provided that breast feeding is complete, successful and un-supplemented, as usually happens when babies take the breast soon after delivery and, thereafter, at short intervals. The effect is greatly reduced if breast feeding is partial which perhaps reduces the sucking stimulus and prolactin secretion (Jelliffe and Jelliffe, 1975).

In the Philippines a study undertaken by Del Mundo and Adiao (1970) demonstrated that a 24-35 month birth-spacing interval was achieved in 51.2 per cent of mothers who breastfed their children for 7-12 months as opposed to only 30 per cent in mothers whose infants were artificially fed.

Reports in England have revealed that infants there are now gaining weight at a much faster rate (Eid, 1970; Taitz, 1971; Shukla et al. 1972) and that the artificially fed babies are gaining more than the breastfed (Taitz, 1971). The gradual and persistent increasing prevalence of artificial feeding which Jordan is witnessing is likely to lead to increased numbers of overweight children and overweight adults in the future. The role of early prevention was discussed in the chapter on feeding practices and weaning patterns.

3. Family Planning, Birth Interval and Contraceptive Use: From the data available on the use of contraceptives one can say that about two thirds of the women in this study are giving birth to unwanted children, and even then, they are not doing or planning to do anything about this problem. The key to successful family planning is the desire of individuals to control the number of their offspring, a desire which was clearly present among a large section of the mothers (40.5 per cent) in this study. For this desire to be successfully promoted, there need to be lower infant and childhood mortality rates. Better nutrition may reduce the desire for children through improving the health and assuring the survival of those already born. Furthermore, combining such a family planning programme with a nutrition rehabilitation or mothercraft programme specifically designed to promote the health and survival of the children may help to reduce resistance to family planning programmes, through convincing the parents and especially the fathers that the programme is concerned with health and welfare as well as with the number of children.

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Finally, this long discussion on the different aspects of family planning and the use of contraceptives, would not be complete without mentioning two important facts related to the use of contraceptives:

1. The effect of contraceptives on maternal nutrition: Oral contraceptives may interact with some essential dietary nutrients. Increased iron absorption may occur, together with higher needs for folic acid, B_{12}, pyridoxine and tryptophan possibly of special significance in communities where such deficiencies are already common like folic acid deficiency in pregnancy (Jelliffe and Jelliffe, 1975).

2. Effect of oral contraceptives on lactation: Available evidence seems to suggest that the earlier ovulation-supressing contraceptive compounds given by mouth with large doses of both oestrogens and progestogens frequently had a deleterious effect on the production of human milk, especially if introduced soon after delivery, and often made it impossible to continue breast feeding.

More recent experience with combined oral contraceptive pills with a low oestrogen content has varied, but usually there have been no ill-effects on lactation (Jelliffe and Jelliffe, 1975).

4. MORTALITY PATTERN

It is now well established that infant mortality may result from a variety of influences. These include purely physiological factors, the availability and quality of medical care for mother and child and a wide range of social and economic attributes covering, not only the period of pregnancy, but also possibly the environment of the mother during her own childhood. Efforts to apply statistical methods to data relating to infant mortality are greatly complicated by the number of factors involved, by the close association among many of these factors and by the complexity of the underlying biological process. The practical difficulty of controlling so many variables makes the relative importance of the various contributory agents very difficult to assess.

However, in order to make the best possible use of demographic data, it must be known to what extent they are accurate. It is now recognized that population statistics suffer almost unavoidably from a certain degree of inaccuracy, even if all necessary precautions have been taken in planning and performing the counts.

Birth registration in Jordan was found to be almost complete and accurate (Wander, 1966); under-registration of births for the whole country was found to be 2-4 per cent of all births. However, in some areas, mainly among the nomadic and semi-nomadic groups there is still some reluctance to register female births.

According to the same study (Wander, 1966) death reporting was found to be only about 40 per cent complete in the period from 1959 to 1963. It was also found that the split in competence between the two responsible government agencies, the Ministry of Health and the Ministry of the Interior, was a basic reason for this unsatisfactory result.

a. Mortality of Siblings - Results

In this study an attempt was made to estimate the mortality in infancy and early childhood among the siblings of the children in the survey. Answers to the following questions were obtained from the mothers:

1. Total number of pregnancies the mothers in this study had: 23,545
2. Total number of abortions and stillbirths the mothers had: 2,711
3. Total number of live births (by subtracting 2 from 1): 20,834
4. Number of siblings who died in the following age groups:

a. less than 1 month:	542
b. 1 month to 1 year:	1,088
c. Infancy:	1,630
d. 1 - 4 years:	239
e. More than 4 years:	104
f. Unknown age:	8
g. Total (all age groups):	1,981

Because it was almost impossible to get the number of livebirths in each age group separately and accurately, we used the total number of livebirths in this study as a general denominator for calculating the mortality rates for different age groups, for the mortality rate corresponding to each special age period we used the number of siblings who died in that particular age period as numerator. The rate was then calculated per 1,000 liveborn. Figure 43 shows these calculated rates; the neonatal rate was 26, the post-neonatal was 52, the infant 78, the 1 to 4 years was 11.5 and the mortality rate for age more than 4 years was 5 per 1,000 livebirths. (Table 151).

The number of abortions and stillbirths will be discussed in the section on obstetrical data.

Table 152 shows the numbers of children in Group A and Group B who had and who had not had deaths among their siblings, according to different age intervals when the siblings died.

There were no significant differences between Group A and Group B except at the age period 1 to 4 years. The proportion of deaths occurring at this age was twice as high in Group B as in Group A, a difference which was significant at the 1 per cent level.

<u>Discussion of Mortality Pattern:</u> In recent years there has been more attention to death rates by age groups. The mortality pattern in Jordan as it is in most of the developing countries, reflects the socio-economic and health status in the country. The calculated infant mortality in this study (78.23 per 1,000) is 4.4 times as great as it is in a country which is advanced; the 1-4 mortality rate 16 times greater. Another simple way of expressing this situation is that while in Sweden less than 5 per cent of the total deaths occur under the age of five years, we have here a high percentage of

children dying in infancy. Almost half of the deaths in the first year occur in the first month of life. It is known that where such a high mortality persists, it is obviously accompanied by a high morbidity. Together with a shortened lifespan and seriously reduced productivity, these factors have grave results on the physical, mental and economic state of the country.

Many efforts were made to explain to what extent certain mortality rates of children under five years can be used in conjunction with other information to define public health nutrition targets.

Table 153 shows the calculated infant, post-neonatal and 1-4 years mortality rates for Jordan as seen in this study as ratios of United Kingdom rates for the year 1971.

Infant mortality rate exceeded the United Kingdom rate by a factor of 4.1, however the 1-4 year mortality exceeded the United Kingdom by a factor of 14.3.

It was shown in a study by Gordon et al. (1967) that the second year mortality rate accounts for much of the excess of 1-4 year mortality rates in developing countries.

Another study (Cook, 1969) showed a high correlation between the per capita income and the mortality rates of the post-neonatal period ($r = -.599$); 1-4 year period ($r = -.718$), and the second year mortality ($r = 0.861$); but did not show a similar trend when infant mortality rate was correlated with the per capita income ($r = -.399$).

Cook in this article concluded that children spend much of the period between the end of the first month of life and the end of the second year in a state of vulnerability brought about by three factors:

1. Relatively high nutritional requirements
2. Transition from breastfeeding to normal family diet
3. Lack of their own antibodies to infectious organisms.

He brought evidence to support the impression that a large proportion of these deaths are attributable to malnutrition.

Figure 43 - calculated mortality rates

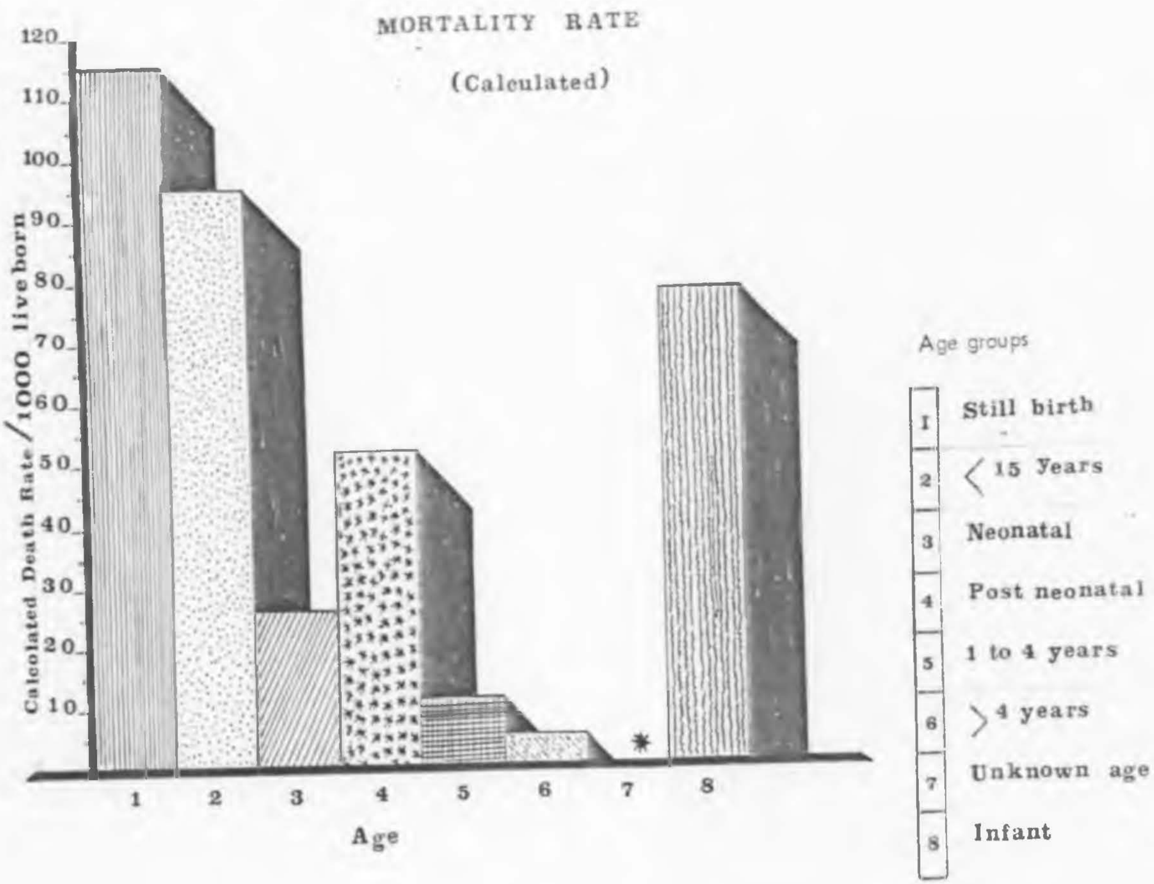
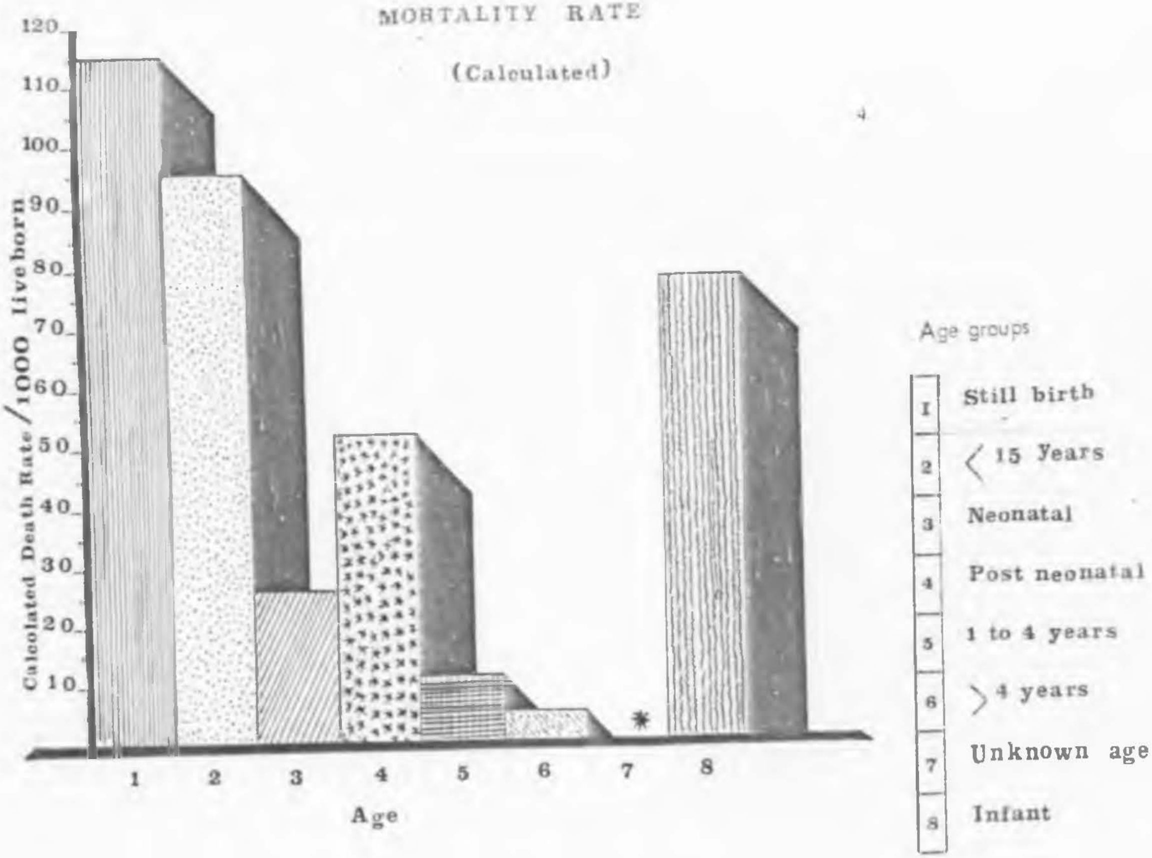


Figure 43 : calculated mortality rates

MORTALITY RATE

(Calculated)



MORTALITY RATE

(Calculated)

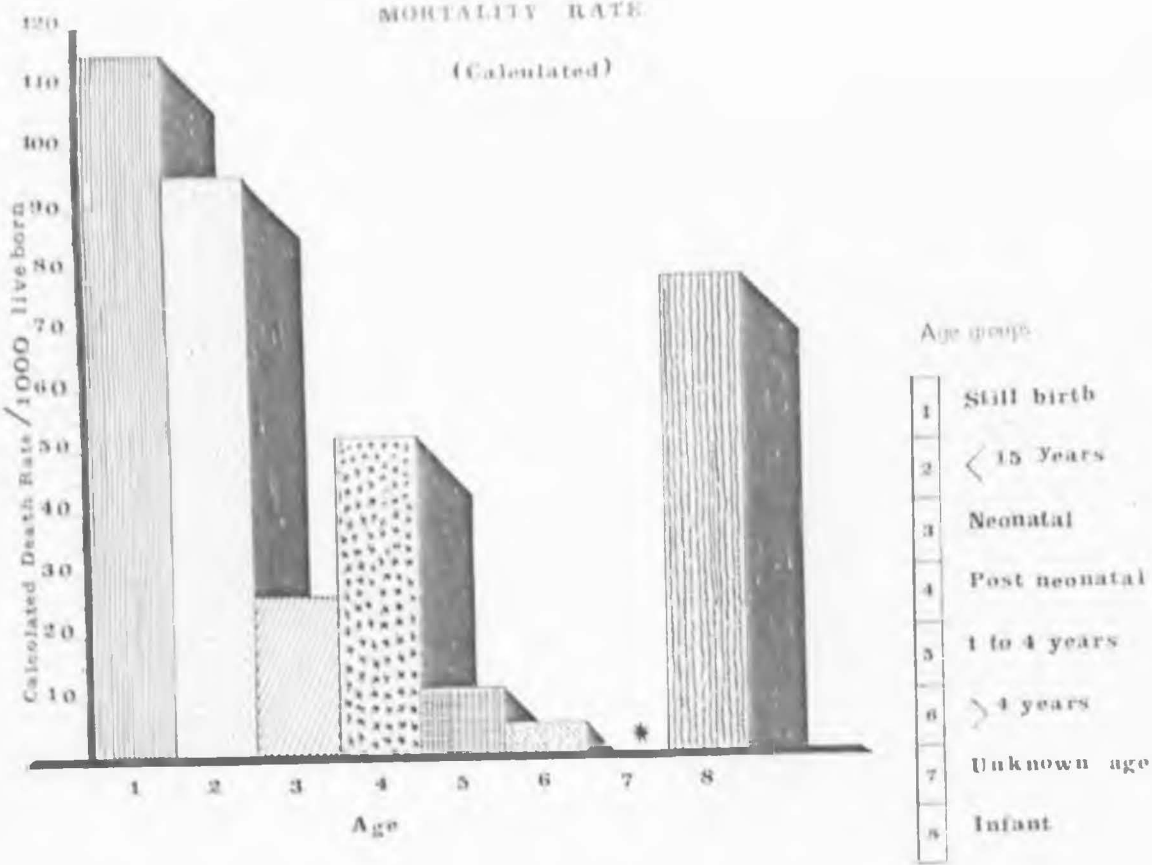


Table 151

THE AGE DISTRIBUTION OF SIBLING DEATHS IN THE FAMILIES OF THE INITIAL STUDY POPULATION OF 3,734 CHILDREN

Age of deceased sibling	No.	Percent
Less than 1 month	542	27.3
1 month - 1 year	1088	54.9
1 year - 4 years	239	12.0
4 years and above	104	5.2
Unknown age	8	0.4
Total	1981	100.0

Table 152

NUMBER OF CHILDREN IN THE TWO NUTRITIONAL GROUPS WHO HAD AND WHO HAD NOT HAD SIBLING DEATHS, ACCORDING TO THE AGE OF THE SIBLING AT DEATH

	Neonatal		Post-neonatal		Infant		1-4 year		More than 4 years		Unknown age	
Mortality	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
No sibling deaths	3241(88.9)	56(86.1)	2855(78.3)	48(73.8)	2585(70.9)	43(66.1)	3466(95.1)	58(89.2)	3556(97.6)	63(96.9)	3637(99.8)	64(98.4)
Sibling death	402(11.0)	9(13.8)	788(21.6)	17(26.1)	1058(29.0)	22(33.8)	177(4.8)	7(10.7)	87(2.3)	2(3.0)	6(0.1)	1(1.5)
Chi-square value	0.512		0.768		0.713		4.730		0.129		6.396	
P	N.S.		N.S.		N.S.		<0.01		N.S.		N.S.	

Figures in parentheses are in percent; NS. = the difference not significant at the 5 per cent level

Table 153

CALCULATED MORTALITY RATES IN DIFFERENT AGE GROUPS FOR JORDAN (1974 - THIS STUDY) AND THE MORTALITY RATES OF JORDAN (1972, WHO STATISTICAL YEARBOOK) AS RATIOS OF THE U.K. (ENGLAND AND WALES), 1971

Mortality	Jordan (1974) This study	Jordan (1972) WHO Statistical Yearbook 1974*	UK (E & W) 1971* WHO Statistical Yearbook 1974*	Jordan's ratio to UK This study 1974	Jordan's ratio to UK WHO 1972
Neonatal	26.0	4.5	11.6	x 2.2	x 0.38
Post-neonatal	52.2	16.8	5.9	x 8.8	x 2.8
Infant	78.2	21.3	17.5	x 4.4	x 1.2
1-4 years	11.4	-	0.7	x 16.2	-
5-9 years**	4.9	-	0.4	x 12.2	-

*Figures for United Kingdom (England and Wales), 1971 and for Jordan, 1972, as they appeared in WHO Yearbook, 1974.

**The age interval 5-9 years was used for the U.K. and the corresponding age interval for Jordan was 5-14 years.

b. DEGREE OF KINSHIP OF PARENTS AND ITS RELATION TO MORTALITY OF SIBLINGS OF CHILDREN

Cook (1966) estimated the additional mortality suffered by children in a rural area of Jordan on account of consanguinity of their parents. According to his estimate one would say that out of every 1,000 children born in that area in the last twenty years approximately 17 died before the age of one year and a further two or three before the age of five years from causes associated with their parents' consanguinous marriage.

Shull (1958) investigated this subject in Japan. He found in Hiroshima a mortality in the first eight years of life of 116.5 per thousand among the offspring of first cousin marriages, and of 57.7 per thousand among the offspring of unrelated marriages; a difference of almost 100 per cent. He concluded that there was clearly a significant association between consanguinity of parents and mortality of their off-spring.

It was decided to estimate the extent of any additional mortality suffered by those children on account of consanguinity (degree of kinship) of their parents, and so the number and percentages of children in this study who had and those who had not had experienced sibling deaths in the different age periods were classified according to the degree of kinship of the parents.

Table 154 shows that 39 per cent of the childrens' parents are first degree cousins 21 per cent are second degree cousins and 40 per cent are distantly related or not related.

When the degree of kinship was examined against the deaths in the neonatal period, there were no significant relations between the number of sibling deaths and the degrees of kinship; the same was true for the periods of post-neonatal, infancy, more than four years and for the mortality for unknown ages.

However, when the degree of kinship was examined in the 1-4 year deaths there were more deaths among the first degree cousins. This difference was statistically significant at the 5 per cent level.

Table 154

NUMBER OF CHILDREN WHO HAD AND THOSE WHO HAD HAD NO SIBLING DEATHS IN DIFFERENT AGE PERIODS, ACCORDING TO THE DEGREE OF KINSHIP OF THE PARENTS

	Neonatal		Post-neonatal		Infant		1 - 4 years		More than 4 years		Unknown age		Total
Degree of kinship of parents	No sibling death	Sibling death	No sibling death	Sibling death	No sibling death	Sibling death	No sibling death	Sibling death	No sibling death	Sibling death	No sibling death	Sibling death	
First cousin	1272(39.2)	176(42.3)	1121(39.2)	327(40.9)	1011(39.2)	437(40.5)	1364(39.2)	84(46.4)	1414(39.6)	34(40.0)	1445(39.6)	3(92.9)	1448(39.6)
Second cousin	682(21.0)	78(18.8)	597(20.9)	163(20.4)	541(21.0)	219(20.3)	732(21.0)	28(15.5)	746(20.9)	14(16.5)	758(20.8)	2(28.6)	760(20.8)
Distantly or not related	1290(39.8)	162(38.9)	1142(39.9)	310(38.8)	1030(39.9)	422(39.1)	1383(39.8)	69(38.1)	1415(39.6)	37(43.5)	1450(39.7)	2(28.6)	1452(39.7)
Total	3244(88.6)	416(11.4)	2860(78.1)	800(21.9)	2582(70.5)	1078(29.5)	3479(95.1)	181(4.9)	3575(97.7)	85(2.3)	3653(99.8)	7(0.2)	3660(100)
Chi-square value	1.874		0.739		0.622		4.942		1.103		0.442		
P	N.S.		N.S.		N.S.		0.05		N.S.		N.S.		

Figures in parantheses are in percent; N.S. = Not significant

CHAPTER IX

GENERAL DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

This study was designed in 1973 with the aim of observing the factors which influence the growth and nutrition of infants and young children in this rural area near Amman city. It also provides a follow-up of a study carried out in Jordan by ICNND and ICNJ in 1964.

The sample consisted of all children who were 0-5 years old at the time of the study residing in this area. The accurate birth dates of these children were obtained from the birth registry. Children who had congenital malformations or other organic diseases thought to be important in affecting their growth pattern were excluded.

The growth pattern was studied in terms of the following anthropometric measurements: body weight, length (height), head circumference, arm circumference and skinfold thickness (triceps, biceps, subscapular and suprailiac).

The anthropometric survey methods employed in this study proved to be rapid and practical for assessing the nutritional status and growth in this community.

It was easy and possible to train field workers to fill the questionnaire forms and also to do measurements with an acceptable level of accuracy. The field work proved to be very attractive to the male students of nursing and also beneficial experience for the students from the Jordan Institute of Social Work. The participation of the students in these surveys was practical, cheap and served the objectives of the study. It was also pleasant for the students themselves as their contribution in the field was considered as part of the fieldwork required by their respective schools.

The male nurses were efficient in doing the measurements, while the female social work students proved efficient in doing the interviews with the mothers and filling in the questionnaires, especially the parts concerned with maternal and obstetrical data.

In the absence of local standards for norms most of these measurements were compared with international standards from the U.S. and U.K. Classification of children both for public health purposes and for identifying the severe forms of protein calorie malnutrition, depended mainly on the Harvard Standards as cut-off points.

One point which made the assessment of the clinical status of these children accurate was that the examination was mainly done by one investigator in almost all the cases, and by one more physician-nutritionist in some cases. There was full agreement on the interpretation of the findings. Frequent consultations and even demonstrations of some of these cases were done, involving the physicians on the one side and the nursing students in the team on the other. The frequent demonstration of some clinical findings as well as some congenital abnormalities made the field work more interesting for the whole team. Cases which needed specialist consultations or X-rays were referred to the appropriate centres, this ensuresbetter participation by the villagers.

This study has shown that the growth performance was in general better than that reported in the 1964 study. This was attributed mainly to socio-economic and educational developments which occurred in the country during the past ten years.

The growth pattern during the first six months of life was satisfactory. The children showed a drop in their mean weights after the first 6-7 months of their life; by the end of the second year the mean body weight increased and a rapid catch up was achieved.

During the third year the child is usually completely off the breast and thus gets his share of the mixed family diet. This is a safe period when the child can express his hunger and reach for food. Also, by this age the child has passed the critical period when he is most at risk to infections. It is then that the mean body weight approaches the standard.

During the fourth and fifth years the child was getting the ordinary mixed family diet, so the growth increments were satisfactory.

The children in this study were then classified according to Waterlow's public health classification (Waterlow and Rutishauser, 1974). They were divided into fairly narrow age groups and also for males and females. Each group was classified into well nourished and malnourished children. This classification revealed the presence of 1,771 (47.6 per cent) well nourished children, (no action group); 1,874 (50.4 per cent) stunted children (action?); 34 (0.9 per cent) wasted and stunted children (action)and 31 (0.8 per cent) severely wasted and stunted children (priority). In other words the number of children severely malnourished was 65 (1.8 per cent) and we called them in this study Group B and the number of well nourished children was 3,643 (98.2 per cent) and we called them Group A. This classification is unlike the estimates of malnutrition suggested by Bengoa and Donoso, (1974) which divide the malnourished children into mild, moderate and severe forms.

I Factors Related to the Severely Malnourished Group of Children

In this study we tried to investigate the manifold different factors found to have an important influence on the growth and nutrition. Because we have discussed these factors in more detail in the respective chapters, this discussion will focus on the significant factors which were found responsible for precipitating growth retardation. Secondly, the discussion will lead on from the causes and factors to results and conclusions which may help the health authorities to understand the component links in the chain of events which have led in this community to a state of advanced retardation of growth. Thus the complications can be properly identified and the importance of each link evaluated within the context of these local conditions.

a. Malnutrition and its relation to the mothers:

The mothers of the malnourished children in this study had the following significant features:

1. They marry at a relatively young age (less than twenty)
2. On the average they had more than five pregnancies
3. Because of the repeated pregnancies with relatively short intervals and deprivation of the natural stores they are thin and wasted
4. They had a relatively high number of stillbirths and abortions
5. Most of them were del'vered without any technical or professional help; if the labour was difficult then they are sent to hospital to have the delivery done by a doctor.

b. Malnutrition and its relation to the father:

1. Most of the fathers were married to their first cousins

2. The 1-4 year old mortality among the first cousin parents was higher than in the more distant or unrelated marriages.

3. Economically, the fathers were worse off than the fathers of the well nourished children who had two wives.

c. Malnutrition and its relation to the feeding and weaning practice of the child

1. The malnourished children had a pattern of breastfeeding characterised as either short, with early introduction of different brands of cow's milk, usually prepared unhygienically, or prolonged with little dietary supplement.

2. More malnourished children were receiving cow's milk.

3. They were not given any of the following foods as their first diet: legumes, eggs, chicken and vegetables

4. They were given more yogurt and sweets.

d. Malnutrition and its relation to the environment

The environmental factors which were found significantly related to malnutrition were:

1. In general their sources of water were unsafe

2. Most of the families of malnourished children do not have toilets

3. If they had toilets, they were mainly soil ditch, not cement type.

e. Malnutrition and its relation to health education:

1. The mothers of the malnourished children had wrong concepts and beliefs about the health and nutrition of their children

2. They did not boil the water for preparing the milk formula for their children

f. Malnutrition and its relation to the mortality of the sibling

1. The mortality pattern revealed higher 1-4 year old mortality among the siblings of the malnourished group.

II Special Problems

1. Weaning and Supplementary Feeding: Breast feeding is a necessity for infants and young children in this community. Early weaning (before the age of six months) results in increased incidence and early occurrence of diarrhoea and hence malnutrition. It was interesting and unusual to find that about 6 per cent of the children in this study have never been breastfed and also that most of the children in this community were weaned abruptly.

Weaning patterns vary by such factors as when weaning occurs, how long the transition takes, what is fed and the manner in which feeding is accomplished. It is usual to classify the time at which weaning from the breast is completed, as follows:

a. Very early weaning: less than six months

b. Early weaning: less than one year

c. Late weaning: after one and a half years

The nutritional effects of weaning at these particular times will depend not only on timing but also on what is fed and how it is fed.

The age at which breastfeeding stops is an extremely important predictor of risk:

early cessation of breastfeeding in itself confers very great health risks. These have been discussed elsewhere at length.

Introduction of other foods is also highly variable at weaning and is often unrelated to the infant's needs.

The term weaning is used by some to refer to the total cessation of breastfeeding and by others in reference to the time or period at which solid foods, or foods other than milk are introduced (Morley, 1973). In actual fact, in this community it is best for the child if solid foods are introduced long before breastfeeding ceases.

The age at which solid or semi-solid supplements of other foods to breast milk begins is also important in predicting the nutritional status of the weanling. The later solids are introduced the greater is the risk of malnutrition, though very early introduction of solids causes increased risks of infection if the food fed is not hygienically prepared.

After approximately five months of age, semi-solid foods are necessary to supplement the infant's breast milk intake, since at this age breast milk supplies are usually not adequate to maintain good growth.

Infant weight gain is most rapid in the first six to nine months after birth (during the time the infant doubles his birth weight). Weight gains remain high but gradually decrease in the next six months. The normal rate of weight gain in the second year of life is only one third that of the first year, and the rate slows down further in the third, fourth and fifth years. If, as in the children in this study, food is not supplied for growth when rates are high, it may not be possible to recoup losses later (Thomson, 1970).

2. Types of Supplementary Food:

a. The family food:

The family food, which was found to be satisfactory in this study, in the proper combinations may be sufficiently rich in protein, calories, vitamin A, iron and other nutrients to meet needs which cannot totally be met by breast milk. This will allow good growth if the food is given with mother's milk in sufficient amounts and concentrations. It is when the wrong combinations are used in the absence of mother's milk that problems arise.

Table 155 shows the relation between age at which breastfeeding stops and age at which solids are introduced.

Table 155

Probable Relationship of Age at Which Breast Feeding Stops and Solids are Introduced to Health Risks Among Weanlings in Developing Countries*

Age at which breast feeding stops	Age at which solids are introduced		
	Very early < 6 mths.	Early <1 yr.	Late >1½ yrs.
Very early (less than 6 months)	high risk	very high risk	very high risk
Early (<1 year)	low risk	high risk	very high risk
Late (<1½ years)	low risk	high risk	very high risk

*From: Priorities in Child Nutrition Vol. V. Annex: Nutrition Primer Harvard University, School of Public Health

b. Commercial baby foods:

There is a need to encourage the use of family foods in the weaning period. The Protein Advisory Group of the United Nations has suggested the following definition (1973) for weaning foods: "processed, protein-rich foods to serve as supplementary foods for breastfed infants after six months of age, as weaning foods and also as supplements for pregnant and nursing mothers. As a rule such products should not be recommended for infants below six months of age".

Unfortunately, all commercial foods used for feeding infants do not fall within this definition with respect to being rich in protein and other nutrients. Neither are they always used as supplements to the diet after six months of age. Rather, they are used as substitutes for breast milk under six months of age. This is extremely hazardous.

The food industry can make an enormous positive contribution to nutrition throughout the country and especially to the nutrition of the young child.

Some products on the market are valuable but they are beyond the purchasing power of many people in this community. On the other hand some products are not valuable from the nutritional, as well as from the economic (price) point of view.

Among the poor sector in this community, risks of contamination are high if commercial baby foods are fed by those who do not understand their proper use, especially when they are fed almost exclusively to a child under one year old. The use of commercial baby foods by the poor in this community brings up the following problems:

i. Complication and disruption of traditional patterns of weaning: weaning from bottle to cup and from the special baby foods to the family diet introduce extra steps in the weaning process.

ii. Confusion: health workers and mothers may be uncertain as to the age at which solids should be fed with resulting variations and unsupervised practice. If baby foods are fed below four months of age, there is a high risk of contamination under the usual hygienic conditions existing among the poor in this community.

iii. Costs: the extremely high prices of these commercial baby foods, regardless of protein and other nutrient content, place them beyond the means of most consumers in poor countries.

iv. Improper use of these foods: these products are not designed as complete foods to be used as a source for all nutrients, but may be improperly used as such, rather than as supplements to milk based diets.

v. Variable nutritional value: from low to high in protein and other nutrients. There is a need to establish food standards for all the baby foods in the country.

vi. Need for refrigeration (in the case of some foods).

c. Special protein-rich foods:

Because of the various difficulties encountered with commercial baby foods, other forms of baby food should be developed which are high in protein, energy and other nutrients.

A number of successful weaning food mixtures of this type have been developed; such foods are a helpful tool in many situations for teaching mothers about the special needs of children.

However, these products are unlikely to be the final solution for the problems of weanlings in Jordan. The following points should be properly considered:

i. The major problem which remains once the considerable obstacle of manufacturing, packaging and marketing have been solved, is cost. This should be within the reach of all children. Government subsidies would almost certainly be necessary if weaning foods were to be used by the vast bulk of the poor population.

At the same time it is clear that foods at the time of weaning need to be higher in protein as well as in calories.

ii. A second problem is acceptability: parents may not feed their children such rich weaning foods even if they could afford them

iii. A third problem is that such products should be distributed properly to the far rural areas and that use should not be limited to some rich families in the big cities.

iv. Unless locally available foods are used, then the country would rely on food donations and supplements which are either imported or not available at home.

v. They may be imported foods which are provided by international or bilateral agencies and hence, uncertain in supply at least over the long term.

Imports of bulk commodities, either free or on concessional terms may be available to feed weanlings. Especially designed and prepared foods have now been developed (WHO/UNICEF, 1972).

The development of corn-soy-milk (CSM) and wheat-soy-blend (WSB) by the U.S. government was perhaps a more successful effort than many other country developed products. These products are distributed through a bilateral aid programme and not as self-sustaining efforts of the country itself. There are also other disadvantages in relying on such aid to feed weanlings (Berg, 1973). While the food may be free, other costs are high - at least one third over the cost of food. While it may represent an acceptable form of foreign aid, it does imply reliance on outside sources for food and discourages local manufacturing and government initiatives. There may also be problems with the black market and actually getting food to the consumer. The primary reason for food aid may be political, and technical details such as objectives and evaluation of the programme may not be carefully thought out.

3. Combat against Infection:

Infectious diseases represent a problem to the weanling in terms of their direct effects on health and alterations of the physiological requirements and utilization of nutrients. They are also a problem because of their indirect effects in precipitating malnutrition, due to the changes in maternal feeding procedures during times of illness as well as to decreased appetite, decreased food intake, increased energy expenditure, decreased absorption and increased outputs of nitrogen by the child.

These infectious diseases include diphtheria, pertussis, typhoid, intestinal parasites, food borne infections, various other types of diarrhoea and malabsorption syndromes, respiratory infections, otitis media and measles. The weanling in this community may be continuously assaulted by one or more of these conditions. The possibility of spread of infection, due to changes in the environment may be greater at some times than at others. The environmental hazards affecting the weaning process often make it particularly riskyduring the summer months or when the infant is ill, as gastrointestinal disturbance and dehydration are most likely to occur. This combat against infection should comprise:

a. Major efforts to improve environmental sanitation and to guarantee a satisfactory water supply

b. Mass immunization programmes against diseases such as TB, smallpox, diphtheria, tetanus, pertussis, polio and measles to be carried out during the first year of life.

4. Family Planning

Most of the emphasis in family planning has largely remained on the size of the family rather than on birth spacing. Limiting the size of the family demands a behavioural change. A campaign for prolonged birth interval does not require a fundamental behavioural change, and thus has an increased chance of success.

In order to have the best possible relationship between the health worker promoting a family planning programme and the villagers in Jordan, the following points should be taken into consideration:

1. The health worker must understand the attitudes of the recipient towards disease and objectives in life.

2. The present status of communication between the doctor in rural Jordan and the recipient of health services is poor. This relationship is slightly better between nurses in clinics and recipients. Local nurses and health workers often understand the people's beliefs and attitudes better than the professional health worker.

3. Parents in these areas expect from their children either physical strength in terms of growth and stature or ability to do well in school. The educational programme must stress the scientific evidence that the child born after an adequate birth interval is healthier and stronger and will do better at school than the child born after only a short birth interval.

4. Breastfeeding should be considered as part of the reproduction physiology and closely inter-related with family planning. Maintaining breastfeeding for a long period should be a major teaching responsibility of health workers.

5. Education and Training

Education and training in nutrition should be promoted on all levels. The key personnel to be reached are the staff of MCH services and other groups should be reached such as home economists, teachers, social workers, etc.

The programme should, as much as possible, make use of material from the pertinent area and could comprise various activies such as:

a. Workshops, seminars, etc. arranged on a national basis
b. Nutrition courses for university graduates
c. Nutrition courses for intermediary and low level personnel
d. Field training and field surveys.

6. The Role of the Health Services in the Control of PCM

There are two groups of children for whom specific efforts of health workers should be directed:

1. Children at risk

2. Children suffering from PCM

The activities required include efforts directed towards reducing the following:

1. The number of children suffering from severe PCM

2. The incidence of complications in severe PCM

3. Mortality rates due to severe PCM

4. The number of moderate cases progressing to a severe state.

In actual practice, what can be done depends almost exclusively on the quantity and quality of the resources available to this purpose.

These objectives mentioned above can be reached through the combined efforts of curative, rehabilitation, preventive and promotional activities. This section is concerned to outline what those activities might be. Through this section an indication on the assistance in the form of equipment, food material, training facilities and vehicles might be expected to yield positive results in the control of malnutrition through the health sector.

a. The role of hospitals in treatment and prevention of malnutrition

The effectiveness of curative services can be very low when treating advanced protein energy malnutrition, especially if complications exist. Although hospitals in Jordan treat malnourished children in great numbers, the treatment given is often inadequate because of lack of facilities, trained personnel, etc. Treatment is usually focused on the complications of the intercurrent episodes such as bronchopneumonia, diarrhoea and measles, and child may return to his home as malnourished as he was when treatment began. Generally there is no coordination between the curative measures given at the hospital and the follow up provided by the Health Centres after the child's discharge. The net result of inadequate hospital treatment with no follow up is that the resources expanded for each fully-recovered child can be very high.

Some facilities for the hospital treatment of the severely malnourished child exist in most of the hospitals in Jordan. Hospital treatment is expensive and it has been very ineffective in terms of money spent for each complete recovery.

In order to increase the cost effectiveness the following points should be followed:

I Adequate dietary treatment

II Adequate treatment of complicating episodes

III Education of mother or both parents

IV Follow up of discharged patient at home, and referral to nutritional rehabilitation centres.

Hospital staff should take an interest in the prevention of relapses as an important way of increasing the efficiency of their work and for avoiding an overloading of curative services with relapsed cases. Insufficient coordination of the curative and preventive aspects of programmes dealing with severe PCM is a factor responsible for the low level of efficiency and the high hospital mortalities.

I Adequate dietary treatment in hospital can be improved by:

a. Programmes to train physicians and nurses in the dietary and medical treatment of malnutrition. The high calorie requirement for recovery from marasmus (Ashworth, Bell, James and Waterlow, 1968, and Graham, Cordano and Baertt, 1963) is often not understood and an insufficient diet can prolong hospitalization. When effectively applied, this therapy shortens treatment and saves money.

b. Making certain that necessary foods are available. Mothers themselves might help in supplying the food for the hospitalized child.

c. Setting up a dietary kitchen for the treatment of malnutrition is important to decrease cross infections.

II Adequate treatment of complicating episodes. The most important complications in malnutrition are electrolyte/acid based distrubances (mainly as a consequence of diarrhoea) and infections. The provision of diagnostic tools at the laboratory level (micro-biological, electrolyte/acid base) are essential for shortening the period of hospitalization through better diagnosis and prompt specific treatment. The training of physicians in treating the complicated cases by means of travelling seminars and the provision of hydration equipment and fluids.

III Education of the mother or both parents. There is a need at the hospital buildings for greater preventive measures, such as providing facilities for the education of the mother or both parents. The instruction should include the basic factors regarding the cause and treatment of the child's illness; nutrition and health; environmental hygiene at the home level; what to do when the child is ill, etc.

I Adequate dietary treatment in hospital can be improved by:

a. Programmes to train physicians and nurses in the dietary and medical treatment of malnutrition. The high calorie requirement for recovery from marasmus (Ashworth, Bell, James and Waterlow, 1968, and Graham, Cordano and Baertt, 1963) is often not understood and an insufficient diet can prolong hospitalization. When effectively applied, this therapy shortens treatment and saves money.

b. Making certain that necessary foods are available. Mothers themselves might help in supplying the food for the hospitalized child.

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IV Follow up of the discharged patient.

a. In the home: here the availability of vehicles increase effectiveness through mobility. Also programmes to provide extra and/or special foods for home treatment are bound to produce quick recovery.

b. In the health centre: watch must be kept for relapses. The child discharged from the hospital after treatment should be referred to a health centre whenever possible. Programmes should be developed to provide teaching and demonstration facilities at health centres. Programmes directed to providing transport facilities might make these activities more possible and effective.

b. <u>Nutrition Rehabilitation Centres in Treatment and Prevention of PCM</u>

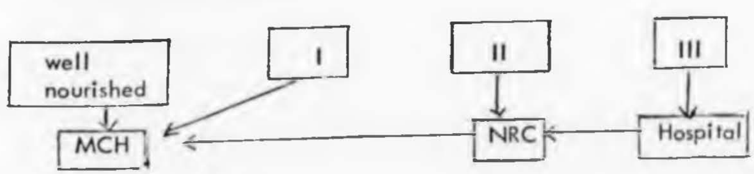
The concept of Nutrition Rehabilitation Centres was introduced by Bengoa, based on a scheme which divides children in the community into two groups: nourished and malnourished, with further division of the latter category into three gradients - mild, moderate and severe, as shown below.

1. Nourished (well baby or healthy child)
2. I Mildly malnourished
   II Moderately malnourished
   III Severely malnourished

The objectives of the Centre are:

a. To rehabilitate the child

b. To educate mothers



The MCH service provides care for the well and mildly malnourished child; the hospital service (after costly and unsuitable long term convalescence due to cross infection and other reasons) is meant to deal with severe cases, and the Nutrition Rehabilitation Centre is intended to fill the gap between the two extremes. In rehabilitating the child and educating the mother, such centres, if well supervised and operated, could play a decisive role in the prevention of malnutrition recurrence in the rehabilitated child as well as the occurrence of new cases in other siblings.

The centres are usually placed in simple and very modest facilities. Mothers are taught about nutrients, feeding of children and the recovery process. Since no medicines are administered, mothers come to realize that drugs are not necessary for nutrition rehabilitation.

The director of the centre is a school teacher, who is trained in nutrition education and operates the services under the supervision of the physician in charge of the adjacent Health Centre.

Although the N.E.R.C. has several advantages (i.e. effective care, reduced cost, spare hospital beds for the severe cases), it also has some limitations. This type of service can only operate in urban communities and places with proper transportation. Children are usually kept for fifteen days with the possible risk of outbreaks of communicable diseases, although they should all be immunized on admission. Mothers often like to follow their own ways. The need for adaptation to the local setting was also cited as a limiting factor.

In evaluating the effectiveness of the service, the following criteria are used:

1. Performance and growth of the child during and after the rehabilitation phase
2. Changes in family feeding and dietary habits
3. Performance of other children in the family
4. Number of cases coming from the same community with second and third degree malnutrition.

c. <u>Prevention and Promotion</u>

Close and continuous observation of the nutrition of individuals and of the factors which determine health in a community should be achieved in two ways.

I Early warning of situations which can lead to a deterioration of the nutritional condition of large numbers of individuals, such as wars, displacements, internal troubles, economic crises, agricultural disasters (droughts) or epidemics.

II The identification of individuals who are at 'high risk' of becoming severely malnourished.

The proper identification of the conditions which actually mean 'high risk' can operate on two levels:

1. On the population at large: methods employed here should be simple like the Quak Stick for example (Arnhold, 1969), or the head circumference/arm circumference ratios (Kanawati and McLaren, 1970).
2. At health centres and MCH centres here, the definition of high risk can be documented more thoroughly by monitoring failure to thrive or the socio-economic situation of the family. The child who meets the criteria is given special treatment and priority subject to the limitations of the available facilities and resources.

Figure 44 is a suggested preventive programme of malnutrition in Jordan based mainly on the findings of this study.

III Recommendations

1. Rural mothers who are experts in breastfeeding should be encouraged to continue this practice. Great efforts should be exerted to motivate the others who are not breastfeeding.
2. Weaning should not start until about the age of six months, to be gradually completed by the age of one year.
3. Abrupt weaning and early, unsupervised supplementation of breast milk should be discouraged.
4. The type of weaning foods that can be given as supplements to breast milk should be especially studied, together with the way they can be administered. The use of family level weaning food should be strongly emphasized.
5. The government and particularly the Ministry of Health should give strong support to the production and distribution of industrially processed weaning foods.
6. The Ministry of Health should participate in ensuring the safety, high nutritive value, palatability and low cost of processed foods. Standards of infant foods for use in Jordan should be examined by properly qualified agencies.
7. Legislation concerning the control of the composition and value of weaning foods in the market and for prevention of misleading standards for their promotion is recommended.

Figure 44

PREVENTIVE PROGRAMMES OF MALNUTRITION IN JORDAN

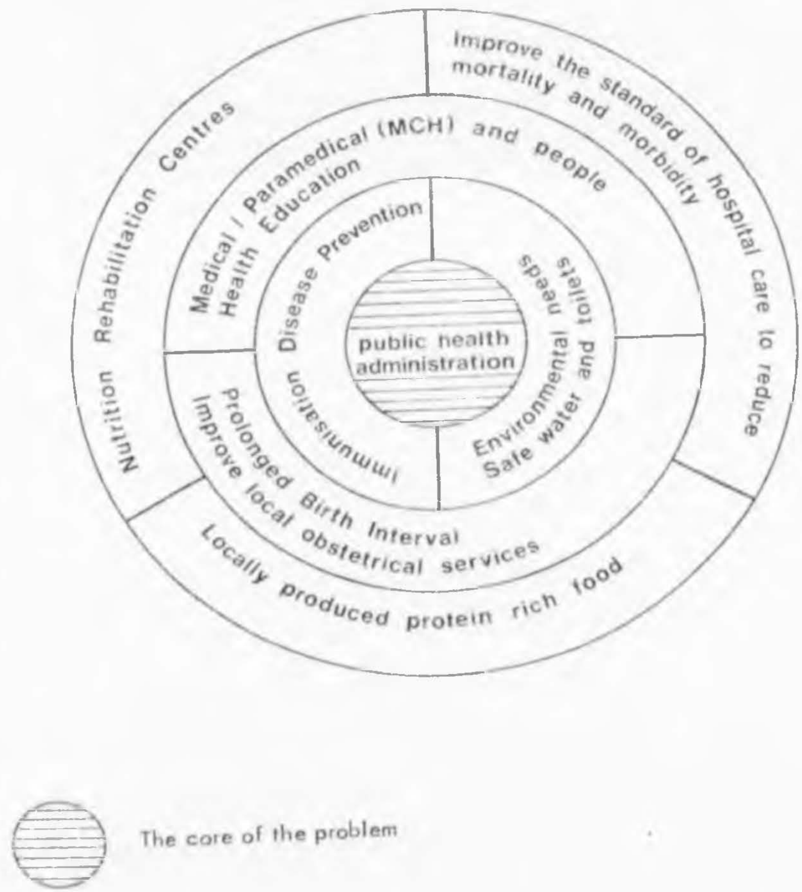
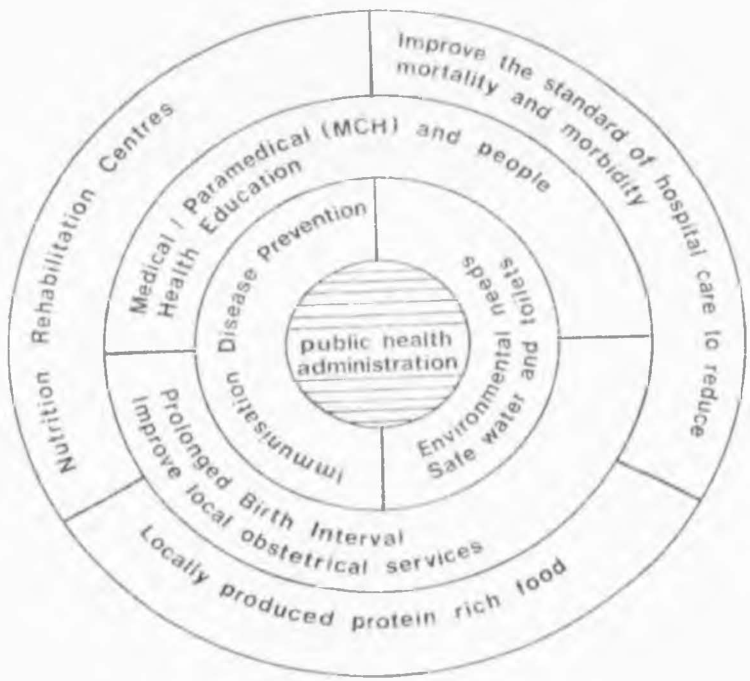
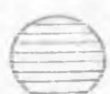


Figure 44

PREVENTIVE PROGRAMMES OF MALNUTRITION IN JORDAN





The core of the problem

8. Major efforts to improve environmental sanitation and to ensure a satisfactory water supply should be made.

9. Mass immunization programmes to be carried out during the first year of life against preventable diseases and especially measles.

10. Planning for the prevention of specific vitamin deficiencies especially vitamin D through proper education and exposure to sunlight.

11. MCH services should be strengthened and expanded for a more complete coverage of the child population in Jordan. Special consideration should be given to the training of physicians, midwives and health visitors responsible for operating the services.

12. Encourage the active cooperation of non-governmental workers and agencies in MCH work.

13. In planning and operating MCH services, an integrated approach, including nutrition education and family planning needs to be emphasized.

14. The establishment of Nutrition Rehabilitation Centres is recommended as an integral part and expansion of the existing health services.

15. Education and training should be promoted at all levels. The under graduate teaching of paediatrics in Jordan Medical School be more community orientated, and include as much as possible of the social and preventive aspects of child health.

16. For adequate planning and evaluation of nutrition and health programmes certain types of demographic and vital statistical data are needed. Accurate and reliable information about death rates especially in neonatal and infancy periods and in the child population 1-4 years of age is essential.

17. There is a need to study the locally used contraceptives as well as their effectiveness and other related matters.

18. Raising the standards of the effectiveness of the present curative services, especially the paediatric services with regard to treatment of nutritional cases and rehydration methods by applying modern methods and the use of micro-methods for electrolyte studies.

19. The pyramid of child health care must be built on a firm base; it should be organized from the bottom up and not from the top down. The main cornerstone for improving the child health care in Jordan must stem from properly organized health services. Public health administration is the core of the problem as shown in figure 44; new organization, staffing and set up is needed.

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